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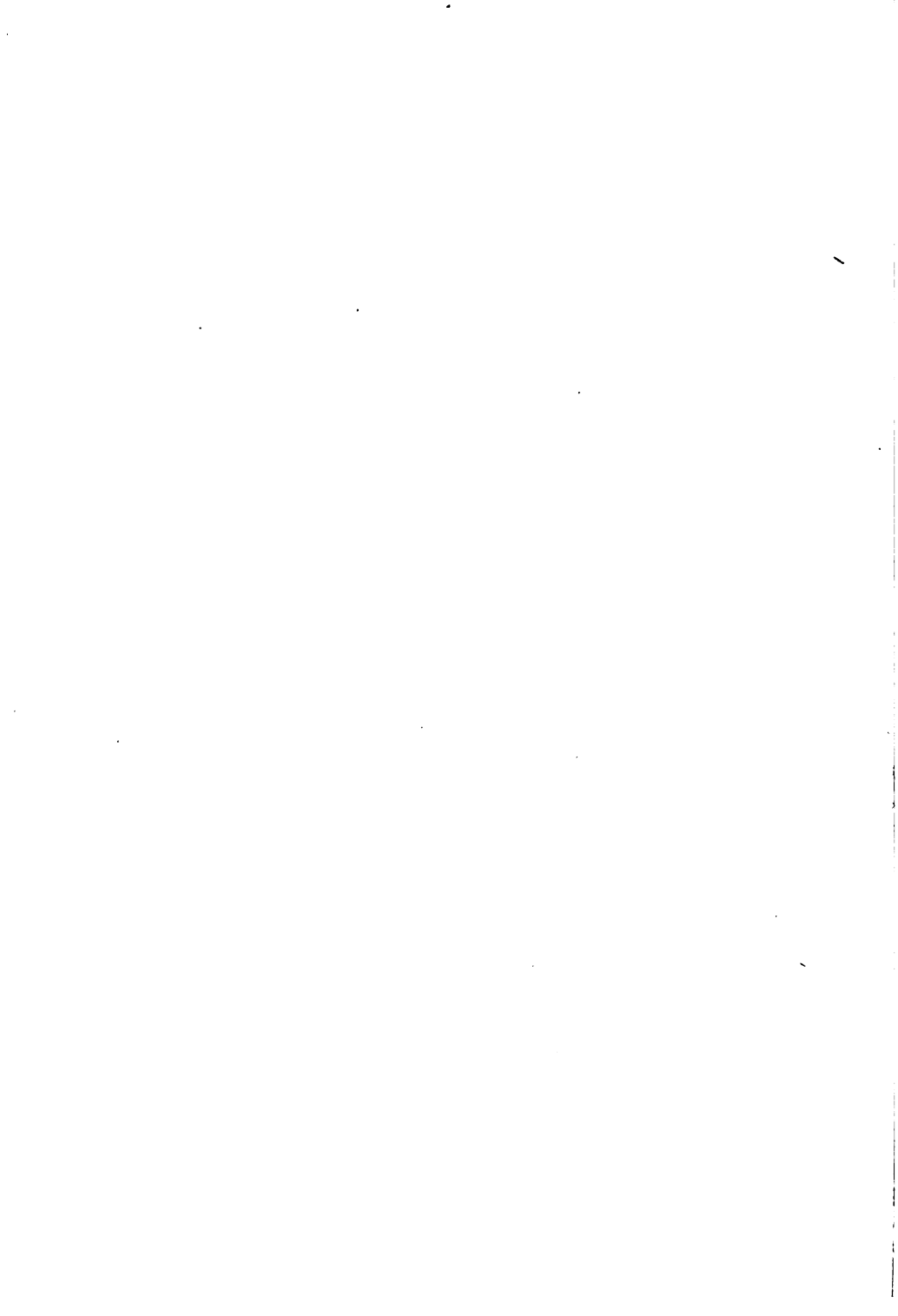
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IN EIGHT VOLUMES

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VOLS. VI AND VII, IMPORTANT ADDRESSES, BIOGRAPHICAL, AND HISTORICAL PAPERS, ETC.

VOL. VIII, MISCELLANEOUS ARTICLES, AUTHORS' AND COMPLETE TOPICAL INDEX

DR. JACOBI'S WORKS

COLLECTED ESSAYS, ADDRESSES, SCIENTIFIC PAPERS AND MIS- CELLANEOUS WRITINGS

OF

A. JACOBI

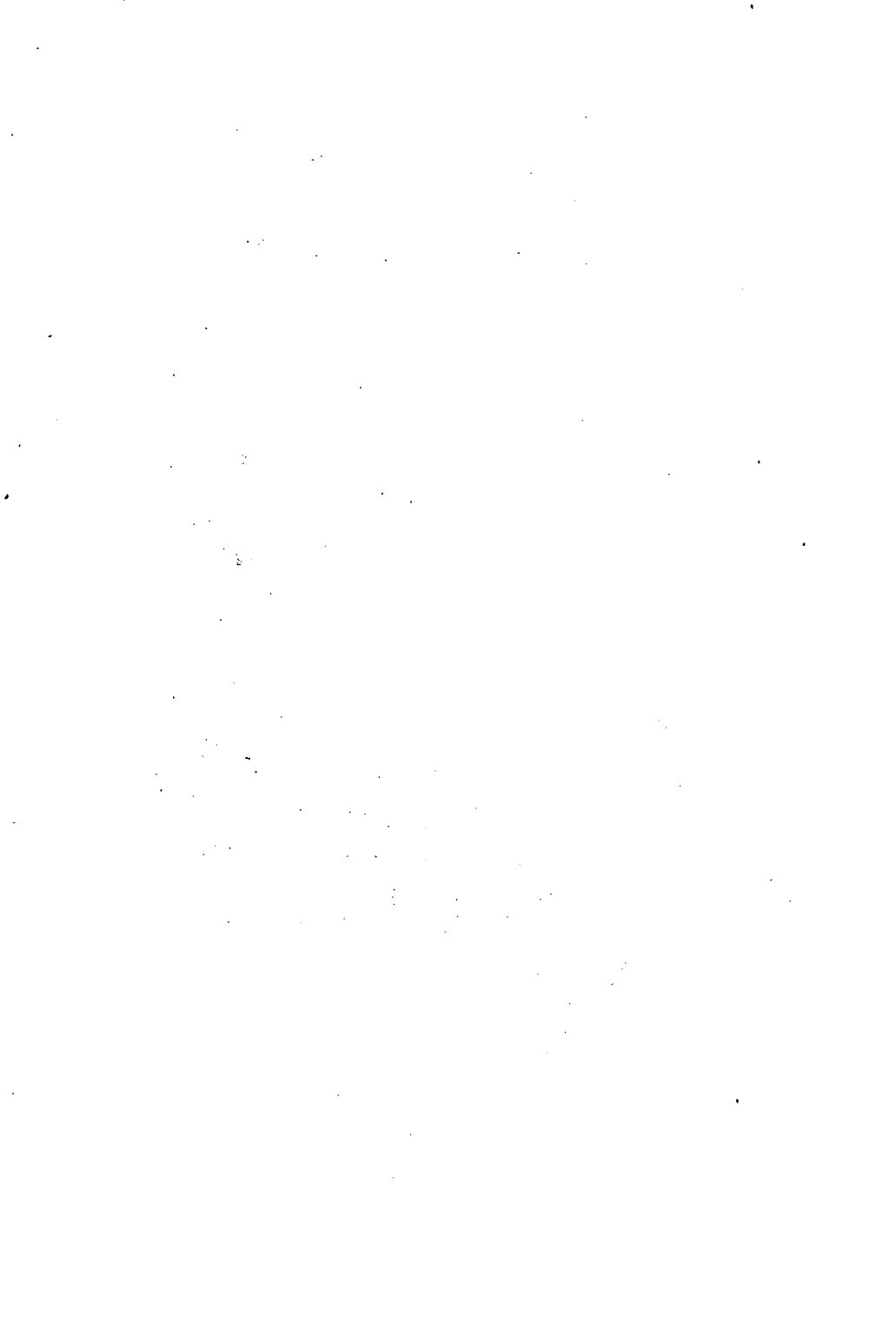
M. D. UNIVERSITY OF BONN (1851); LL. D. UNIVERSITY OF MICHIGAN (1898), COLUMBIA (1900), YALE (1905), HARVARD (1906).
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Honorary Member Yonkers Medical Association, Louisville Obstetrical Society, Abingdon, Va., Academy of Medicine, Brooklyn Medical Society, Medical Society District of Columbia, New York Obstetrical Society, Medical and Chirurgical Faculty of Maryland, American Laryngological Association, Pediatric Society of St. Petersburg, Pediatric Society of Kiev, Royal Academy of Medicine, Rome, Deutsche Gesellschaft für Kinderheilkunde, Verein für Innere Medizin of Berlin, Royal Society of Medicine of Buda Pesth.

IN EIGHT VOLUMES

EDITED BY WILLIAM J. ROBINSON, M. D.

NEW YORK

1909





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CONTRIBUTIONS
TO
DIATRICALS

BY
W. JACOBI, M.D., LL.D.

VOL. I

EDITED BY WILLIAM J. ROBINSON, M.D.



NEW YORK
CRITIC AND GUIDE COMPANY
12 MT. MORRIS PARK WEST
1909



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CONTRIBUTIONS
TO
PEDIATRICS

BY
A. JACOBI, M.D., LL.D.

VOL. I

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NEW YORK
THE CRITIC AND GUIDE COMPANY
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1909

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In Memory

of great and good men long departed,
citizens of a hospitable country

In Gratitude

for countless favors and honors received
at the hands of colleagues, pupils,
societies and universities
during half a century.

A. Jacobi

AUTHOR'S PREFACE

TO MY READERS—If there be any—I desire to give an explanation of, or an apology for, the appearance of these volumes. For many years friends have encouraged me to write my memoirs. They claimed that the Parcæ had not cut the thread of my life only to give me an opportunity to report what I had observed in connection with the history of the profession of the country in a medical practice extending over almost sixty years, as a public teacher of medicine during forty-five years, and a member and an officer in many local, national and international associations. That may be true, but as a memoir writer I have not succeeded in being prolific beyond a few chapters which, with others, may or may not reach the eyes of my friends, and enemies, for a long time to come, if at all. A very good reason for that is intelligible to every New Yorker. We have no time for anything but work; the luxury of leisure we do not possess; and pleasure is enjoyed only, or mostly, by those who find pleasure in work.

So no memoirs could be written, on account of constant, and constantly pressing work. Pegasus wears no harness, and I, like most of you, have always been in harness. Whether that was always an enjoyment or a benefit to others, I cannot tell you. But I believe I may assure my present readers that my memoirs, if they ever be written, will prove that my professional

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life, taken all in all, was very successful, if not always lucky or happy.

To demonstrate that, a few reminiscences may be permitted here; they may be repeated, amongst others, posthumously, may be ante-posthumously.

The first of my professional successes was the fact that it took my first patient only a fortnight after my new shingle began to ornament No. 20 Howard street, to call on me with his twenty-five cent fee. That was in November, 1853. I must have had quite a reputation at that time, for his only excuse for coming at all was that he had heard of me. I think I must have gathered many more such fees, for after less than four years I was one of the founders of the German dispensary, in which treatment was strictly gratuitous. About the same time of this memorable achievement of mine, Dr. Stephen Smith, that good and glorious man, accepted from me a long series of extracts from European journals and books, mostly on diseases of children, and within another year, he was pleased to accept, what I am still pleased to call, original articles. About the same time my inexperience made me try my first lecture on half a dozen suffering students (in the Spring course, of 1857) of the College of Physicians and Surgeons. I nearly broke down, more or less deservedly. My subjects were the diseases of the young larynx and laryngismus stridulus. *Nolens volens* I exhibited in my own person an attack of laryngismus. We all survived. A similar experience I had three years afterward when I had been made professor of infantile pathology and therapeutics in the New York Medical College, then located on East 13th Street. If some one were anxious to learn how I, with my knowledge of

AUTHOR'S PREFACE

pathology and therapeutics, which indeed was rather infantile, became a professor, this is how it happened. A friend of mine, who has a tablet of his own in the history of American obstetrics, had taken a chair in the reorganized school. So my dear Charles Budd wished me to go in with him, and came as a committee to offer me a place in the faculty. When I used what I had of common sense and replied that I did not feel competent, he tried his great art on himself. He *delivered* himself, with forcible tongue, of so many uncomplimentary remarks about me, that I accepted his terms at once.

The very next year, the eighth, I made a heap of money out of literature, which is remarkable for a medical man, unless he be Weir Mitchell, or Osler, or Holt. It happened this way,—perhaps someone wishes to imitate me. Indeed, I believe he should. In 1859, E. Noeggerath and I published a big volume, "Contributions to the Diseases of Women and Children," at an expense to ourselves of \$800; a few years afterward we sold the edition as waste paper for sixty-eight dollars, a clear profit—compared with nothing.

Thirteen years passed, and I suffered from fire; some rare books and specimens that I could never replace burned down with the University Medical College building on Fourteenth Street. Over the ashes of my property Tammany Hall was erected, which refuses to burn, at least in this world. About the same time I cashed my first big hospital check in the shape of a petechial typhus, of which I got well after public prayers had been offered by some good old ladies.

After seventeen years, I scored quite a success when I—refusing to resign—got myself expelled from a pub-

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lic institution for proving a hundred per cent. mortality amongst our babies, and for insisting upon a farming-out system. Thus things have been going on for years and decades, with and without any merit of mine. Once, only a few years ago, I had even my style criticized, if not corrected. There was a gentleman who had been working for a hospital thirty years. Then the matron found fault with him, and *vice versa*, and he was told that he would be permitted to resign, if he could not adapt himself to the lady. He resigned, for it is not everybody that prefers to be expelled. Thereupon, and on account of this maltreatment of a meritorious officer, I offered my resignation, which was accepted because the tone of my letter was declared to be unpleasant.

Such specimens of the practical wisdom of other people I have enjoyed many times. Once in a while I had (like Jonathan Swift) to write or talk for their betterment, if not for their approval. Thus for instance: In another hospital the trustees interfered with the mode of electing medical officers, contrary to their own by-laws, which they might have altered if they had waited only two weeks. But they were in such a hurry to override themselves and overturn their doctors! So I had to send them my message that they were no longer a parliamentary body, and also my resignation. In the course of a long life I have scored a choice lot of successes of that and other kinds, but after all, the definition of success as understood by different people varies very greatly.

Still I must not forestall my future memoirs, which must be expected to contain many experiences not always of a pleasurable order. But, at least, they have been instructive. I learned from them, and the lessons

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derived from them have benefited me, and as I intended they should, perhaps others. That my methods were always correct or politic, I do not say. Indeed I am certain that if I had displayed more patience in my attempts at improving such conditions as I found faulty or defective, I might have been more successful in carrying my points. I trust my mistakes, some of which may be traced in a number of papers, may interest my friends of the growing generation. They may remember Cicero, who found that "the ears of the masses are dull," that a truth, when unpleasant, requires more than a single promulgation. Perhaps the revolutionary spirit of my youth and a warm temperament which boiled at a low temperature, made me overlook the slow pace at which reforms are established. Reforms require alterations of opinions and tendencies, and organic changes are of slow evolution. Looking backwards forty years, I can imagine that the very ladies of the Nursery and Child's Hospital, like the trustees of other establishments, impressed with their good intentions and the originality of their positions, elated by the financial support furnished by the city and the State, but not accustomed to attend to the actual work connected with financial and mortuary records, and adverse to be taught by a mere doctor who proved a mortality in their institution of one hundred per cent., could have been with a certain amount of diplomacy, made glad and proud of improving both their methods and results. My old papers, rehearsed in one of these volumes, will tell a story which has not been the only one since. As our system of controlling public institutions has not met with radical changes, errors of administrations are always possible. If I have any ad-

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vice to give to my colleagues to whom much is given and from whom much is demanded in their connection with public affairs, it is to exhibit more patience but no less firmness.

But I forget that this is no pulpit or platform. My following remarks may be briefer. The friends who urged me to republish old papers complained of their being hidden in transactions and forgotten magazines, and regretted that half of them were never reprinted, and that such reprints as existed at all were not accessible, except in a few large libraries. Some were more considerate than others. They wanted me to publish merely a volume or two of my therapeutic papers. So I began a process of examining and sifting, and here is the result. There are a number of historical studies. They contain facts and references which may prove useful to those who are in need of them. Indeed, there are persons whose historical interests are not limited to what has happened since the beginning of the twentieth century. Some are even so learned as to quote others besides themselves and their friends. An objective report of historical facts should always be welcome. The history of medicine is neglected amongst us. Only of late we hear of an occasional course of lectures on this most important subject, and I know of no professorship, not even lectureship, on the history of medicine in our schools.

With the exception of a single quarterly journal devoted to the history of medicine, we have only John Watson's "The Medical Profession in Ancient Times," 1856; "The Nose and Throat in Medical History," by Jonathan Wright; Alvin A. Hubbell's "The Development of Ophthalmology in America,"

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1800-1870, 1908; Samuel D. Gross "Lives of Eminent American Physicians and Surgeons," 1861; "A Century of American Medicine," by Clarke, Bigelow, Gross, Thomas and Billings, 1876; the valuable works of Packard and Mumford, and a very few others (Roswell Park, N. S. Davis). We have no systematic attempts at writing up ancient, modern, or our own medical history.

The history of diphtheria is illuminated in a number of my papers. I have seen the scourge since 1858, and written about it many times since 1860, thus embodying our advancing knowledge on the subject until to-day. The clinical description has not made much progress these many decades. Therapy, however, has changed wonderfully. O'Dwyer's intubation rendered tracheotomy almost obsolete—indeed, after seven hundred tracheotomies of my own I have had no opportunity to operate since O'Dwyer; and Behring's antitoxin has reduced the mortality to one-third. That the antitoxin is useless in the very worst of septic cases, is pitiful; still more pitiful is the fanaticism of all possible sexes which objects to the bold use of alcohol, the best of antiseptics in these desperate and otherwise hopeless cases.

In many of my addresses, those, who will look for them, may find many facts connected with the establishment of pediatrics as a special study and a subject of special teaching. It is a delight to know that beside J. Lewis Smith, Rotch, Holt, Huber, Griffith, Koplik, Northrup and Forchheimer there are scores of younger men who are forming what may be termed an American school of Pediatrics.

The development of institutions, such as the New

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York Academy of Medicine, the Societies of the City and County, and State of New York, of libraries, and of national and international congresses will also be found alluded to, or discussed. At all events I believe that an attentive reader will be rewarded by much useful material. A number of cases reported dozens of years ago, have never lost for me the interest I took in them when they were first observed. I hope that my many talks on the principles of medical ethics will coincide with the opinions of most of my readers. The moral groundwork of a gentleman's feelings and behavior was always the same, through centuries man's heart has always been human, only tastes differ and usually in trifles. Whether the profession of America will always object to a physician taking out a patent I do not know. They permit it in Europe. Whether we shall always object to a man printing his actual or pretended specialty on his shingle or his card, I cannot know. They do it in Europe; but I trust, we shall always deem it objectionable, as soliciting presumptuousness or lack of taste. But these things show perhaps only absence of judgment, but no lack of heart and conscience. But that there are men in the profession who give or demand bribes, take "commissions" from apothecaries, instrument and bandage makers, nurses,—men and women—manufacturers, in the shape of cash or stock, consultants both medical and surgical—that is no longer professional, no longer even the competition of an honest tradesman: it is robbery, which pollutes the moral atmosphere of professional life, and fleeces the consumer of your services, i. e. the patient.

My views regarding the principles of therapy, both

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hygienic and medicinal, I trust are agreeable to those who live a modern life, without superstitious belief in things because they are old, and without faith in the new stuffs merely because they are new.

Many papers and addresses contain my views concerning the most important and momentous question at all times and before all nations, viz: the feeding of infants. If the problem were settled to everybody's satisfaction, it would not be necessary to speak again at this place. It is a satisfaction however to know, that modern physiology and biochemistry have not changed the practical teaching furnished me by domestic and clinical observations these more than fifty years. That a number of men high in our ranks are joining me quietly and unostentatiously in giving the babies a fighting chance against overdone theories and detrimental practices of notoriety-seeking persons, is a source of congratulation. Long may they live, I mean the babies. Those friends of mine and of all the babies are not the ones you so often meet in connection with interviews, haphazard telephone conversations and reports of cases in the daily papers. They are clever enough to avoid being called in the public columns "expert in the diseases of children," "famous professor of pediatrics," and what not. Indeed these short-sighted people prefer to make an honest reputation of their own—and they succeed.

In regard to the discussion of medical and sanitary problems in the daily press, our views may not always agree. It is customary to extol it, like the stage, and the pulpit, as the indispensable, omniscient and moral and most influential power. I mean to join in that praise—of its possibilities, but I think we could add

AUTHOR'S PREFACE

to its indispensability, omniscience, moral power and influence, without the necessary commission of many mistakes on the part of an uninformed, though ever so bright news-hunting, reportorial staff. What I have occasionally proposed was this, that a great paper should have on its editorial staff a thorough medical man whose whole or most of whose work should be dedicated to the study and discussion of popular medicine and sanitation in all its branches. Give him a large salary and be sure you will strike a cheap bargain by paying him well. At that rate your paper will secure, for ten thousand dollars a year, a reliable report and sound criticism of what you and your public is anxious and entitled to learn.

A still better plan is this. In matters of political and social importance hundreds of newspapers have their central bureau, the Associated Press. The newspapers of the country should have their central bureau of sanitation and preventive medicine. Let them spend as much money on this center, say thirty or fifty thousand dollars, or more,—as much as a single large life insurance company spends for a medical staff, for its commercial purposes. At that rate the papers can procure whatever knowledge there is, both old and new, and may at once become what they wish to be, and wish to be credited with, and deserve to be,—fountains of popular science, teachers of the people, founders of a more intelligent, better informed, and healthier nation. The central bureau should be for all, furnish equal information for all, both for the people and its governments, without the dangers of grave mistakes, misleading sensationalism and corrupting competition.

I should add a few words in regard to myself and

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the editor of these volumes. Dr. William J. Robinson has been my critic and guide. If I have fault to find with him it is that as a critic he was too lenient. It gave him evident pleasure to republish whatever appeared to contribute to the demonstration of the life-evolution of a man whose public utterances seemed to him to furnish some, though ever so slight, additions to the scientific, mental and ethical acquisitions of the medical profession and its standing in the commonwealth. Being a good citizen himself, a determined adversary of doubtful or wrong practices amongst us, a strenuous fighter against past and present evils and in favor of a right-minded, strictly scientific and ethical future, he thought he met in my writings a congenial spirit and sympathetic though modest ally. That is why he, though occupied with the duties of a medical practice and the editing and practical creation of three scientific journals—including his epoch-making "CRITIC AND GUIDE"—has burdened himself with the arranging, editing, printing, proof-reading, translating, indexing, binding, indeed everything connected with the production of these volumes. If there be any merit in them it is his; if the books lead to any praiseworthy results, the credit belongs to him.

19 East 47th Street.

A. JACOBI.



EDITOR'S PREFACE

I KNOW of no other man, either among the living or among those who have passed on, who in our country has had such an important influence on the development of medicine in all its phases, as has Dr. Abraham Jacobi of New York. The adjective important is, however, not adequate nor quite satisfactory. An influence may be important, and yet not beneficial; or it may be only partially beneficial, and it is sometimes a vexed problem to determine whether a man's influence has been more beneficial than harmful or *vice versa*. No such problem confronts us in estimating the activity of Dr. Jacobi. For his influence has been *wholly* for the good, for the highest good both of the profession and of humanity. Bear this last word in mind. For great as Dr. Jacobi is as a physician, great as a teacher, great as an investigator, he is equally great as a humanitarian. Not here is the place, nor is mine the ability to speak of Dr. Jacobi's services to medicine proper; of his services to pediatrics; of the debt the little children the world over owe and forever will owe him; of the thousands of lives that he has saved personally; nor will I dilate here upon the indebtedness the profession owes him for holding aloft and lighting its path with the torch of therapeutic optimism in the midst of the stark-darkness of therapeutic pessimism and despair; nor will I speak here of his services in having brought American and Euro-

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pean medicine closer together, his services in making us—those of us who deserve to be respected—respected abroad. I hope that all this will be adequately and properly done in another place by an abler pen than mine. What I want to allude to here is Jacobi, the physician-man. Jacobi belongs to the noble few who have perceived that the dispensing of pills, powders and decoctions is not the physician's only function, nor even his highest function. He belongs to the noble few who many years ago perceived that many diseases had a social-economic basis, and that if we wanted to do any good we had to improve the economic and sanitary conditions of the people. And this he preached at every opportunity—even when his preaching was not welcome. He belongs to the noble few who regard the physician's rôle as something more than that of a reliever of aches and pains—he perceived the rôle of the physician's rôle as something more than that of a sanitarian, a preventer, a critic, a guide. And while he has sometimes been a severe critic, he has *always* been willing and ready to act as a guide. And his guidance has always been a safe and reliable one.

What attracted me to Dr. Jacobi long before I had the pleasure of his personal acquaintance was his sturdy honesty, his rugged fearlessness, which one could readily feel in his public speeches and addresses. He never missed an occasion to inculcate a wholesome lesson. And he was never afraid of his audience. Where another person would pour out fulsome, cloying praise, he would offer healthy criticism; where another person would dispense nothing but taffy, Dr. Jacobi would present a good dose of Epsom salt; to dispense *undeserved* flattery has always been as distasteful to

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him as to receive it. And if his audience did not like some of the wholesome but bitter truths that he gave them, why, he just let them dislike them. His addresses, at the various annual, decennial, semi-centennial and centennial celebrations, his presentation and banquet speeches, are very, very many in number. I have read them all, and I cannot think of one which could be characterized merely as a conglomeration of nice, soft words, of adulatory, obsequious, flattering phrases; there is not one, as far as I remember, that does not contain some gentle satire (or one perhaps not quite so gentle) on our foibles and failings, on our egotism, on our desire to seem what we are not, on our sins of omission and commission. By his frank speeches he has made some enemies—well, we love him for the enemies he has made.

The entire history of American medicine during the past half century—is reflected in Dr. Jacobi and in his writings. Not only has he been a faithful chronicler, but, what is more important, he has been to a great extent the maker of this history. He has kept tab on the progress of medicine in every one of its branches, and he has always kept step with the procession. Often, very often, we find him in the vanguard, but never, never in the rear, never among the laggards. And he who wants to know the history of medicine in America during the past half century, must read the writings of A. Jacobi. Therein he will find expressed its hopes and disappointments, its progress and backward movement; every step leading to the elevation of the profession he will find therein praised and encouraged, while every step tending to degrade our great profession, every step leading to falsehood,

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hypocrisy, mediocrity and commercialism has been scorched by him in no uncertain terms. Excellent as is the quality of Dr. Jacobi's writings, their quantity no less excites our admiration. Especially so, when we recollect that he has not rehashed any text-books and then published them as his own, and that he has never written because of an unquenchable *cacoethes scribendi*. No, Dr. Jacobi writes only when he has something to write and he speaks only when he has something to say. Unfortunately many of his essays and papers have been hidden away in periodicals which are not readily accessible, or in society transactions which are altogether inaccessible; some of his addresses have never been published, and others have been delivered or written in German. Some of the admirers of Dr. Jacobi, among whom I most emphatically count myself, have thought it a great pity to have so many of his excellent, important and even epoch-making writings become practically lost. They thought it an injustice to Dr. Jacobi and a sin against posterity. Dr. Jacobi was approached on the subject. With the modesty of true greatness he could not see it our way. He did not think that his writings were really of such importance, etc. Finally he was prevailed upon. And I have been honored with the task of selecting, editing, arranging, translating and preparing for the printer the enormous mass of the material of which Dr. Jacobi is the author. The task seemed an enormous one, but no task is difficult into which you put some love. How I have acquitted myself of this labor of love, I leave others to judge.

The arrangement of the matter is, as far as feasible, both by subjects and chronological, but no pedantic

EDITOR'S PREFACE

rule has been followed. A more or less logical arrangement seemed to us the best.

In writings extending over a period of over a half a century, some repetition is unavoidable. To minimize this, the articles have in some cases been condensed. Others have, on account of their historical value, been considered too important to admit of their abbreviation or condensation in any way. And it was considered much better to incur the risk of occasional repetition than to run the danger of eliminating and losing a single historically or scientifically valuable sentence.

For the sake of historical fidelity, it has seemed best, as a rule, to leave the spelling and the nomenclature as they appeared originally. We will therefore meet in these volumes: anæmia and anemia, hæmorrhage and hemorrhage, peritonæum and peritoneum, hypermanganate of potassa and potassium permanganate, hydrochlorate of ammonia and ammonium chloride, therapeutical and therapeutic, etc., etc. The author has kept pace both with the simplified spelling and the constantly changing pharmacopeial nomenclature.

May these volumes which we trust will remain a monument of Dr. Jacobi's varied activity *aere perennius*—more permanent than bronze—also serve as an inexhaustible source of inspiration to the profession of our country, the profession which Dr. Jacobi has loved so well, the profession which in spite of its imperfections remains the noblest of all professions!

WILLIAM J. ROBINSON.

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INTRODUCTORY CHAPTER *

UPON me has been conferred the honor of introducing to the medical public the essays of all the distinguished men contributing to this great work. Though with some hesitation, it is with still more satisfaction that I comply with this demand. For the very enterprise marks an immense progress in the history of both general medical and pediatric literature. Indeed, when I began my professional life, such a collection of monographs as will here be offered could not have been written. Now, that during a single generation there should have been such a thorough change in the methods of both medical thought and work, is a source of the most intense gratification, as well to me as to every other man who has absolute faith in the persistent evolution of science and the improvement of the race.

That there should be any doubt as to the propriety of a large special work on the diseases of children, I can hardly believe in the present stage of development of American medical literature. As far as I am concerned, I never objected to being found among the adversaries of the wildfire of specialism which has been spreading among the groups of medical men. On the contrary, I am still of the opinion I expressed eight years ago when I opened the first session of the Section on Diseases of Children, of the American Medical Association, at its meeting at New York.

With more pertinacity than logic, pediatrics (comprehending the anatomy, physiology, pathology, and therapeutics of infancy and childhood) has also been claimed as a specialty. This is a mistake, however, which has been made more frequently on the continent of Europe than with us. It is there that practitioners and authors

[* This formed the Introductory chapter to Keating's "Cyclopædia of the Diseases of Children." It has seemed appropriate to use it as the introductory chapter to the volumes on Pediatrics.—*Editor*.]

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advertise themselves, for reasons of their own which would not be approved of here, as "children's physicians" and "specialists." Pediatrics, however, is no specialty in the common acceptance of the term. It does not deal with an organ, but with the entire organism at the very period which presents the most interesting features to the student of biology and medicine. Infancy and childhood are the links between conception and death, between the foetus and the adult. The latter has attained a certain degree of invariability. His physiological labor is reproduction, that of the young is both reproduction and growth. As the history of a people is not complete with the narration of its condition when established on a solid constitutional and material basis, so is that of man, either healthy or diseased, not limited to one period. Indeed, the most interesting time and that most difficult to understand is that in which a persistent development, increase, and improvement are taking place.

This appears to have been felt, instinctively, from the very beginning. The history of pediatrics, therefore, is as old as that of medicine. Their literatures have developed uniformly, from superstitious beliefs to empirical statements and the methodical researches of the present time. The last centuries, particularly the last decades, are replete with text-books on the diseases of children, monographs on their pathology, physiology, and hygiene, and journals, quite a number of which are now published in the four principal languages of the civilized world.

These monographs and journals have contributed a great deal to the amount of medical knowledge. Special researches of the normal condition of embryonic, foetal, and infant growth, the study of the functions of the organs in their constant development and changes, and anatomical and clinical investigations, have contributed to prove that pediatrics does not deal with miniature men and women, with reduced doses and the same class of diseases in smaller bodies, but that it has its own independent range and horizon, and gives as much to general medicine as it has received from it.

There is scarcely a tissue, or an organ, which behaves

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exactly alike in the different periods of life. The bones contain less phosphates in the young and exhibit other chemical differences, their anatomical structure is different, their increase less periosteal, than in advanced years. The cartilaginous condition of the epiphyses gives rise to a number of disorders; the cartilages between the epiphyses and diaphyses are subject to all forms of disease, from a simple irritation resulting in abnormal growth (for instance, after eruptive fevers) to a separation, by suppuration, of the epiphyses. There is hardly a chapter more interesting than that of the relation of the bones of the cranium to its contents. A solid skull serves as a support to the brain and its blood-vessels, or it may prove an obstacle to their development; an insufficient degree of ossification, and an undue amount of sutural substance, will enhance the possibility of enlargement of the blood-vessels and the liability to effusion. Premature ossification, however, either partial or general, is a cause of asymmetry, epilepsy, or idiotism, and influences the course of intercurrent diseases. The large size of the head, which is equalled by that of the thorax about the middle or the end of the third year only, is in close relation to the physiological growth of the brain and its pathological changes.

The vertebral column is quite flexible, but straight, and mainly so in its upper portion. Its very flexibility is a ready cause of the frequent occurrence of scoliosis. Its distance from the manubrium sterni is so small that occasionally a thymus, and frequently enlarged lymph-bodies, are a cause of irritation or compression. The base of the thorax is, however, relatively wide, while its height is less. This becomes particularly striking by the almost rectangular insertion of the ribs at the transverse processes of the vertebræ and the sternum, and by their almost horizontal and circular position by which the respiration becomes less costal, and the viscera of the abdominal cavity, mainly the liver, appear more prominent. Changes of a pathological character are quite frequent about this time, and a frequent cause of disease in later life. Hueter's researches on the congenital contraction of the chest, and Freund's investigations on the premature ossification of the

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costo-cartilaginous junctures, are exceedingly important, inasmuch as they explain many of the isolated cases of thoracic insufficiency, phthisical habitus, and pulmonary incompetency.

The nervous system of the young is but in a preparatory condition. The brain is large, but contains a large percentage of water, is soft, and its gray and white substances differ but little in color and composition. The spinal cord has not yet the consistency of a later period; the anterior horns are predominant, and therefore more frequently the seat of pathological changes. The peripheral nerves are relatively large, but little excitable, in the first days. Their excitability grows very fast, however, towards the end of the first year, and quite out of proportion with the slow development of the inhibitory centers. Thus it is that about that time convulsive symptoms are so very frequent. For a short time after birth the conducting fibres between the undeveloped brain (it takes the psycho-motor centers of Ferrier and Hitzig a month to exhibit the first signs of existence) and the pyramidal fibres of the cord perform no functions; thus the first movements of the newly-born are not controlled by will-power at all, but subject to reflex exclusively. After that time the brain develops very fast indeed, but far from uniformly in all its parts. It is a most interesting study thus to follow the evolution of the cerebral functions in their dependency upon the anatomical development.

The digestive organs of the infant exhibit a great many peculiarities in their anatomy, physiology, and pathology. The epithelial "pearls" along the median line of the palate, and the thinness of the mucous membranes over the roof of the oral cavity and along the gums, give rise to early trouble, the small size and vertical position of the stomach to a number of abnormal symptoms, the congenital malformations of the intestine to serious dangers, the abnormal length of the lower part of the colon to an unusual form of protracted constipation, the prevalence of polypi in the rectum to hemorrhages of a kind seldom found in advanced age. The glands required for the digestive processes are but gradually prepared for their

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functions. The salivary glands are but partially active at birth, the pancreas requires time for its full development, the secretion of lactic predominates over that of muriatic acid in the stomach, the intestinal lymph-bodies are in part, particularly the patches of Peyer, so behind their future size and formation as to change their functions considerably. The time of dentition adds to the interest of the period, more, it is true, from a physiological and anatomical standpoint than on account of pathological reasons; for its alleged causal connection with the large number of diseases attributed to its mere occurrence has been greatly exaggerated.

In connection with these brief remarks on some of the peculiarities of the alimentary tract of infancy, I may be permitted to merely allude to the question of nutrition and feeding. Several meetings of the Children's Section of the German Association of Physicians and Naturalists, the last one of that in the American Medical Association, and the deliberations of every medical society in every land, prove its importance. These questions belong, as special studies, eminently to pediatrics; physiology and chemistry can teach the general principles only, and to clinical observation is left the final settlement of the hygiene of infancy. The relation of nurse's to mother's milk, the utilization of cow's milk in all its different forms as one of the constituents of artificial foods, the value of farinaceous admixtures, the addition of animal foods, the proportions of salts and water, the quantity to be administered, the length of intervals between meals, the alterations required in sickness, are just so many questions which demand persistent study and special industry.

The blood and the organs of circulation exhibit the most interesting differences in the young as compared with the adult.

The young infant (and child) has less blood in proportion to its entire weight; this blood has less fibrin, fewer salts, less hæmoglobin (except in the newly-born), less soluble albumin, less specific gravity, and more white blood-corpuscles than the blood of advanced age.

There are some other differences, depending on age, in

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the composition of the blood, more or less essential. The foetal blood and that of the newborn contain but little fibrin, but vigorous respiration works great changes in that respect. Nasse found the blood of young animals to coagulate but slowly. In accordance with that observation, it strikes us, in regard to cerebral apoplexy of the newborn, that the time for coagulation of the blood must be longer than in the adult; for hemorrhages are apt to be most extensive in the infant. In the sanguineous tumor (kephalhæmatoma) of the newly-born, the blood remains liquid in the sac for many days. In apoplexy it is apt to spread all over the hemispheres, and has plenty of time to perforate and penetrate the pia in all directions, destroy much of the cerebral tissue, and flow down the spinal cavity. These occurrences are so frequent in the infant, and so rare in the apoplectic adult, that they can hardly be explained except through the insufficient coagulability of foetal and infant blood.

The size and vigor of the newly-born heart offer a ready explanation of the rapid growth of the infant body, and mainly those organs which are in the most direct communication with the heart by straight and fairly large blood-vessels. In this condition are the head and brain. Thus the latter has an opportunity to grow from 400 grammes to 800 in one year; after that period its growth becomes less marked. At seven, boys have brains of 1,100 grammes; girls, of 1,000. In more advanced life its weight is relatively less,—1,424 in the male and 1,272 in the female. At the same early period the whole body grows in both length and weight. The original length of 50 centimeters of the newly-born increases to 110 with the seventh year; the greatest increase after that time amounts to 60 (in the female 50) centimeters only. In the same time the weight increases from 3.2 kilogrammes to 20.16 in the boy, from 2.9 to 18.45 in the girl. This gives a proportion of 1 to 6 or 7, while after that time the increase is but three- or fourfold.

The normal relation of the weight of the heart to that of the lungs, between the second and twentieth year, is 1:5-7; in scrofula it is 1:8-10. That means, the heart

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is smaller than normal, in the latter condition. Other parts of the system of circulation exhibit traits of their own. It is particularly in the "torpid" form of scrofula that, by virtue of insufficient circulation, the lymphatic system participates pre-eminently. This fact is the more important, as the size, patency, and number of lymphatics are quite unusual in infancy. Sappey found that they could be more easily injected in the child than in the adult, and the intercommunication between them and the general system is more marked at that than at any other period of life. These facts have been confirmed by S. L. Schenk, who, moreover, found the net-work of the lymphatics even in the skin of the newly-born endowed with open stomata, through which the lymph-ducts can communicate with the neighboring tissue and cells.

In rhachitis, the heart is of average size, but the arteries are abnormally large. Great width of the arteries lowers blood-pressure. This allows of the best explanation of the murmur first discovered by Fisher, of Boston, over the open fontanelles of rhachitical babies, a very much better one than that proposed by Jurasz, who looks for their cause in irregularities of the canalis caroticus. Still, it is a mistake to believe that these murmurs, audible over the brain, belong to rhachitis only. They are found in every condition in which the blood-pressure in the large arteries of the cranial cavity is lessened.

E. Hoffmann discovered the peculiar fact that the arterial pressure is very small in the newly-born animal. Even as large arteries as the carotid, when cut, do not spurt as in the adult. This low arterial pressure is one of the reasons why cords not ligated will often not bleed, with the exception of those cases in which the arterial pressure is increased by a moderate degree of asphyxia, or when the lungs are not inflated in consequence of incomplete development of the muscular strength in the prematurely-born fœtus.

According to a number of actual observations made by R. Thoma, the post-fœtal growth is relatively smallest in the common carotid, and largest in the renal and femoral arteries. Between these two extremes there are

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found the subclavian, aortic, and pulmonary arteries. These are differences which correspond with the differences in the growth of the several parts of the body supplied by those blood-vessels. In regard to the renal artery and the kidney, it has been found that the size of the former increases more rapidly than the volume and weight of the latter. Thus it ought to be expected that the frequency of congestive and inflammatory processes in the renal tissue will be almost predestined by the disproportion between the size of the artery and the condition of the tissue. Moreover, the resistance of the arterial current offered by the kidney-substance depends also upon the readiness with which the current is permitted to pass the capillaries. Now, it has been found experimentally that their permeability is greater, and that within a given time more water proportionately can be squeezed through them, in the adult, than in the child. This anatomical difference may therefore be the reason why renal diseases are so much more frequent in infancy and childhood from all causes, with the exception of that one which is reserved for the last decades of natural life, viz., atheromatous degeneration.

In the arteries of medium and small calibre the elastic membrane is a thin and simple membrane; it is only in larger arteries that elastic fibres will also extend into, and mix with, the adjoining layers. The elastic membrane is particularly thin, may even be entirely absent, where the branches are given off from the arteries. It is here that spontaneous hemorrhages are most apt to take place. It is here also that, in later life, aneurisms are met with, such as find no ready explanation by an injury.

The anatomical structure of the three umbilical vessels differs from that of all the rest of either arteries or veins in many points, principally in this, that there is no elastic membrane and no intima in the arteries. Some elastic tissue is found near the umbilicus, and it gradually increases in the abdominal cavity; but the intima is not developed in the arteries until they are in close proximity to the iliac. Thus by the massive and powerful development of the muscular layer it is explained why there are

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so few hemorrhages though no ligature has been applied to the cord.

The umbilical vein differs from the arteries very much less than is usual with veins and arteries in any other parts of the body. The muscular layer is very large and strong in the vein. There is no intima. None of the three vessels emits branches; there are no vasa vasorum and no nerves in their walls.

Altogether, the growth of the internal organs and the whole body does not proceed uniformly. In this respect the blood-vessels do not stand alone. What Beneke called the morbid disposition of the several ages, is best explained by these variations in growth and power. That author spent much time and labor on the measuring of blood-vessels in particular. It was he that found the arteries proportionately wide until the period of puberty. From that time the heart increases rapidly, and the arteries less. In infancy the relation of the volume of the heart to the width of the ascending aorta is 25:20, before puberty 140:56, and after puberty 290:61. Thus it is that the general arterial blood-pressure of infants is less and the heart-beats are more frequent.

After birth the pulmonary artery is much larger than the aorta; after the first year the width of the former compared with that of the latter is 46:40, in the adult 35.9:36.2, in advanced age 38.2:40.4. It is easily understood to what extent both the normal development and the diseases of the lungs may be influenced by these relative sizes of the vessels. That the size and strength of the right heart should have a favorable influence on the course of a pneumonia is an inference deserving of credit.

The reverse of the normal oversize of blood-vessels in the infant and child is found in abnormal smallness, particularly of the arteries. The worst, and mostly incurable, forms of chlorosis are the results of this anomaly. They have been studied by Trousseau, Virchow, Sée, and others, in connection with a small, or normal, or fatty heart, and in their complications with occasional hemorrhagic diathesis. All forms of persistent anæmia may depend on this insufficient development of the arteries: the specimens

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taken from a woman of thirty-two years, who died with all the symptoms of "essential" anæmia, are in my possession.

To the consideration of the organs of circulation I have given so much prominence because of their pre-eminent influence in etiology. The changes of periods of life and advancing age are mainly occasioned by the alterations in the structure of the walls of the blood-vessels. Their original thinness and fragility occasion hemorrhages in the newly-born, as does their anomalous condition in senility. Nor is there any organ which is not constantly under the control of the blood-current. This chapter would, however, grow to undue length, and encroach too much upon the legitimate province of the special essays devoted to the consideration of the subjects to which I should only allude, were I to continue to enlarge upon them. A few more remarks, therefore, may suffice.

There are anomalies and diseases which are met with in the infant and child only. Among this class we meet congenital diseases and malformations, the affections of the umbilical cord, of the ductus arteriosus, and of the tunica vaginalis of the spermatic cord, atelectasis and cyanosis, the diseases of the thymus, the anomalies of the intestinal tract, congenital constipation, as I have called it, resulting from the exaggeration of the normal length of the long sigmoid flexure, and, finally, rhachitis.

Other diseases are mostly found in children, or with a characteristic symptomatology and course. Both acute and chronic hydrocephalus, acute eruptive diseases, whooping-cough, and diphtheria are mostly found at an early age. Diphtheria is very liable to assume different characters in different ages; even the simple inflammations of the tonsils vary in severity and nature according to the amount of tissue destroyed or new hyperplastic connective tissue formed in the course of repeated attacks. Almost all the diseases of the intestinal tract in children have their peculiarities, and require the special study of foods and hygiene. The majority of cases of intussusception take place in infants, in localities with symptoms of their own.

There are diseases which affect both the young and the

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old; in them the size or nature of the organ, or the difference in the degree of irritability, affect the symptomatology of the case considerably. In the narrow larynx of the child, diphtheria gives rise to the complex symptoms of pseudo-membranous croup. Tracheotomy and intubation are subjects eminently belonging to pediatrics. In the vulnerable infant only, intestinal worms will give rise to convulsions; and the large majority of cases of poliomyelitis and polioencephalitis also are reserved for infancy; indeed, so great is the difference between the ages, that the infant is the proprietor of the *medio-canellata*, while the adult glories in the *tænia solium* as a tenant. Let me add that there are differences of many degrees in many other diseases, accordingly as they occur in the young or in the old. The pneumonia, tuberculosis, typhoid fever, rheumatism, epilepsy, and diabetes of the young differ considerably from the same affections of the adult, in their clinical and, sometimes, anatomical aspects.

Therapeutics of infancy and childhood are by no means so similar to those of the adult that the rules of the latter can simply be adopted to the former by reducing doses. The differences are many. Among the antifebriles cold is tolerated *less*, quinine more, in proportion, than in the adult. So are *antipyrin* and *antifebrin*, also phenacetin. Heart-stimulants are also borne in relatively large doses: thus, digitalis, strophanthus, and sparteine. Caffeine is less advisable except where there is positively no cerebral complication of a congestive or inflammatory nature. Of the narcotics, opium must be watched; its doses must be relatively small. Belladonna is borne in rather large doses, and hyoscyamus can be given in much larger doses proportionately in spasmodic conditions of the bladder than in advanced age. Some of the powerful medicines are required in smaller, some in larger doses. Chlorate of potassium demands great care; carbolic acid becomes poisonous in small doses given to the very young, even externally; preparations of arsenic are borne in rather larger doses for many weeks and months; corrosive sublimate—mercurials generally—in rather large doses, because of the extraordinary immunity in regard to stomatitis and to

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the gastric and intestinal irritation so often observed in the adult.

Now, what has been done to facilitate the acquisition of knowledge on all these points by the student and practitioner of medicine? Very little indeed. There never was any systematic instruction in the diseases of children, by a teacher appointed for that branch of medicine exclusively, until (in 1860) I established a weekly children's clinic in the New York Medical College, at that time in East Thirteenth Street. That was the first of its kind in the United States. When the college ceased to exist (in 1865) I established a children's clinic in the University Medical College and in 1870 in the College of Physicians and Surgeons. In both these institutions, as also in the Bellevue Hospital Medical College, such clinics have existed since, and a number of the medical schools of the country have imitated the example.

In them, a single hour weekly, during the regular courses of the winter, is given to the student of medicine for the special study of the diseases of children, who will, in his future practice, form the majority of his patients. In the course of four so-called years, which the legislatures of our States pronounce sufficient for the attainment of all medical knowledge required for the welfare of the country, the student is pressed very hard for time. There are a number of branches which he is taught to deem worth his while and attention, by being told that he will be examined in them before obtaining his diploma; but the diseases of children are not now among these. To my knowledge, there is no school in the country which lays the least stress on that branch of instruction; for I hope there is nobody nowadays, even among the teachers of medicine, who believes that a few didactic lectures of the professor of "theory and practice" are a sufficient preparation for the preservation of the children of the people. No examination being required by those to whom the student looks for direction and enlightenment, he neglects the study, to find out too late the mistake he has made in so doing.

It is no consolation that in Great Britain the same com-

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plaints are made. But a few months ago the chairman of the Section of Diseases of Children, Dr. Cheadle, spoke in feeling terms of the neglect in the schools and clinical institutions of Great Britain of this most important part of practical medicine, before the British Medical Association. The continent of Europe has made more rapid progress. Most of both the large and the small universities have their chair of the Diseases of Children, not a "clinical" one, which means the authority given an enthusiastic worker to teach as much or as little as he can in an hour weekly, without recognition, thanks, or reward, of a doctrine not officially recognized; they have hospitals in which to teach practically every day what has been taught in didactic lectures and learned from books, and their students know beforehand that they will have to prove, before being permitted to practise, their acquaintance with what they are *compelled* to learn of the diseases of children. Thus it is in France and Italy, in Germany, Austria, and Sweden; thus it is now in Russia, but not so in England and in our country.

What can be done to improve this state of things?

Every future improvement in general medical education will favor the study of pediatrics. There will be a time in the near future when the student in medicine will be aware that he will have to pass an examination in the subjects connected with the physiology and pathology of the young. There will be another time when the medical courses will be both long and numerous enough to permit of clinical instruction in the diseases of children being given three or six times a week, and another in which there will be bedside teaching. For that purpose it is that either special hospitals or large wards in general hospitals are an absolute necessity. It is in them only that the student, and the professional man also, may learn under supervision, and without the danger of each having to fill with victims a burying-ground of his own, both how to diagnose a disease in a child and how to nurse and treat a sick one. In hospitals alone can good observations be made in reference to the course of diseases, and the effects of remedies and methods of treatment.

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Moreover, special societies must be founded for the purpose of studying questions connected with pediatrics, or special sections formed in larger and established associations. The new Children's Section in the New York Academy of Medicine, that of the American Medical Association, and the successful organization of the American Pediatric Society prove the intensity of the interest the American profession has commenced to take in the subjects legitimately belonging to that part of medical science and practice.

Finally, all of the latter, as well as those to which I could but incompletely allude, as all others suggesting themselves to the careful observer and thorough student, must be the themes of persistent individual study. Besides, as there must be time to learn other men's observations, so time must be found to contribute what is new and valuable in every professional man's life. The basis on which to proceed is to be furnished by this Cyclopædia, the introductory remarks to which I am kindly permitted to offer. This book bids fair to contain all that is known at present on the anatomy, physiology, pathology, and therapeutics of infancy and childhood. May the American profession see to it that this same book, while being a digest both of the labors of the past and the attainments of the present, shall become the solid foundation of successful scientific work in both the near and distant future.

THE RELATIONS OF PEDIATRICS TO GENERAL MEDICINE

GENTLEMEN:—Progress and success, in order to be complete and unmistakable, require centralization of means and co-operation of men. The pioneer in his seclusion, the hard-working settler, the thin population of a county, the joining of the disseminated parts to form a state, and the amalgamation resulting in the establishment of a powerful and world-moving nationality, exhibit an example of the geometrical increase of strength resulting from the combination of forces. The isolated labors of the greatest men in the history of science never accomplished anything beyond a spasmodic and stationary advance. Twenty centuries in succession lived on the unchanged teachings of Hippocrates, Aristotle, and Galen.

The establishment of institutions of learning in modern times, mainly since the fifteenth and sixteenth centuries, multiplied the names of men, though none reached those three ancients, who, in contact with others equally disposed, labored successfully in the interests of science. Paracelsus, Descartes, Sydenham, Boerhaave, Van-Swieten, Haller, Pete Frank, and Bichat promoted science, partly through contest, partly through co-operation with fellow-laborers. The multiplication of institutions, the similarity of aims and ambitions, the establishment of faculties and learned societies, accomplished, through the co-operation and friction thus created, a progress more pronounced in decades than formerly in centuries.

The best results, however, were obtained by the voluntary association of scientific men all over the world. In this century, the German Association of Naturalists and Physicians, the British and the American Medical Association, the numerous local and provincial societies, and last, though by far not least, the American Congress of Physi-

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cians and Surgeons, with its many special associations and societies, have not only encouraged scientific originality, but raised the average standard of the profession at large.

That is what the isolated labors of individual men never attained. From this point of view I hailed the proposal to form an American Pediatric Society with satisfaction and delight. Thirty years ago I contemplated the formation of a section for the purpose of studying the diseases of children in the New York Academy of Medicine, and failed. These nine years the American Medical Association had its section on diseases of children, the first meeting of which took place under the presidency of S. C. Busey, and the New York Academy of Medicine has a flourishing pediatric section under J. L. Smith. To-day this national association has convened without difficulties and with all the promises of speedy success. The spontaneity of its origin is a guarantee of vitality and prosperity. My failure at that early time did not signify that no attention had been paid in the United States to the physiology and pathology of infancy and childhood. It simply meant that the relations of pediatrics to practice and to the other departments of medicine were not yet duly appreciated. In most countries in Europe it was the same. In America the names of Dewees, Stewart, Eberle, Condie, Charles D. Meigs, John Forsyth Meigs, and W. V. Keating are still holding an honorable place in the history of pediatrics. But their labors were individual and isolated. Though their teachings were appreciated, the profession at large was not sufficiently advanced to look upon the close and special study of the diseases of children as a necessity from the twofold point of view under which I began early to consider it. I was ever of opinion that not only had special occupation with infant pathology and therapeutics its reward in itself, but its connection with every other special doctrine aided and fostered the intimate and profound knowledge of other branches of medical science and art. Thus the future connection of this society with the Triennial Congress of American Physicians and Surgeons will prove a mutual benefit to all parties concerned.

In an introductory to the "Cyclopædia of the Diseases

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of Children," edited by John M. Keating, I have tried to establish the claim of pediatrics to be considered a specialty. Not that it is one in the common acceptation of the term. It does not deal with a special organ, but with the entire organism at the very period which presents the most interesting features to the student of biology and medicine. Infancy and childhood are the links between conception and death, between the fœtus and the adult. The latter has attained a certain degree of invariability. His physiological labor is reproduction; that of the young is both reproduction and growth. As the history of a people is not complete with the narration of its condition when established on a solid constitutional and economic basis, so is that of man, whether healthy or diseased, not limited to one period. Indeed, the most interesting time, and the one most difficult to understand, is that in which persistent development, increase, solidification, and improvement are taking place.

I have tried to prove that "pediatrics does not deal with miniature men and women, with reduced doses and the same class of diseases in smaller bodies, but that it has its own independent range and horizon, and gives as much to general medicine as it has received from it." My reasoning was that there is scarcely a tissue or an organ which behaves exactly alike in the different periods of life. I tried to prove that assertion by a cursory consideration of the osseous tissue, the nervous system, the digestive organs, the blood and the system of circulation, and the requirements of general therapeutics in the young. To these expositions I added a few remarks on the peculiar character of the diseases of infancy and childhood. There are anomalies and diseases which are encountered in the infant and child only. There are those which are mostly found in children, or with a symptomatology and course peculiar to them; and those, finally, which affect both the young and old, with such varieties, however, both in symptoms and course, as depend on the size or nature of the afflicted organ or organism, or the difference in the degree of its irritability.

The relations of pediatrics to the several special parts

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of the extensive field of scientific medicine are very various. Internal medicine owes many of its best results to the observations made on infants and children. It is in them that constitutional and developmental diseases are either best or exclusively studied. In this connection I remind you only of scrofula, rhachitis, anæmia, and chlorosis. Infectious diseases, such as diphtheria, scarlatina, measles, varicella, parotitis, pertussis, and tuberculosis, mainly of the bones and joints, of the glands and peritoneum, are mostly encountered in infancy and childhood. Neoplasms are not only frequent in young children,—more than forty cases of sarcoma of the fetal or infant kidney alone were collected by me for the International Congress of Copenhagen five years ago,—but rouse the most intense interest, from the fact that Cohnheim tried to trace every neoplasm of later life to its embryonic or fetal origin. All the actual or alleged disorders belonging to dentition, most forms of stomatitis, amygdalitis, and pharyngitis, including latero- and retro-pharyngeal abscess, many of the most frequent and important diseases of the nose with their consequences, and of the larynx, are met with in the young. It is in them that catarrhal pneumonia has been studied principally, atelectasis almost exclusively. Some of the forms of diarrhœa, and still more of constipation, are exclusively the property of young children. It is in them, also, that internal medicine has learned the pathology of muscular pseudo-hypertrophy; from them, finally, that it has improved and increased diagnostic resources, for nobody can study Finlayson's contribution to the first volume of the *Cyclopædia* without finding many of them greatly depending on certain peculiarities of the several infant organs.

The surgery of infancy and childhood is so peculiar, its indications so varying, the number of cases so large, and some of the operative procedures so exclusively or almost exclusively adapted to, or necessitated by, surgical diseases of the young, that the transactions of surgical societies and journals are largely filled with discussions on subjects belonging to the sphere of pediatrics. I remind you of the frequent occurrence of congenital malformations requiring interference; those of the anus and rectum, hare-lip and

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fissured palate, spina bifida and hydrocephalus. The several forms of bone-disease, in the vertebræ, the hip- and ankle-joints which require resection or scooping, demand special knowledge and skill, because of the dignity of the intermediate cartilage. Osteotomy is more frequently performed in the rickety young than at any other age or in any other disease. Tubercular swelling of the lymph-bodies occurs more frequently in the young than in advanced years. The majority of tenotomies are performed on children. Tracheotomy and intubation belong pre-eminently to early age. The largest number of tracheotomies performed by an individual operator is furnished by an author who does not claim any merit as a professional surgeon. The operation for pyothorax is mostly required in the young, and taxes the experience and prognostic judgment of the medical man to an unusual degree, because of the variety of indications depending upon the amount of flexibility of the ribs and the extent of complications. Invagination is mainly seen in the very young. Twenty-five per cent. of all the cases occur under one year; fifty-three under ten. Two-thirds of those under a year are between the fourth and sixth months. Perityphlitis, though rare in infants, is not at all infrequent in children of seven or eight years and upward; and both it and intussusception require often surgical interference. Indeed, so common are the claims on surgical skill in the practice among infants and children, that among the most instructive and interesting surgical treatises are those which discuss the surgery of childhood alone. I will only recall the special works of Guersant, Forster, Bryant, Giraldès, Holmes, St. Germain, and the fifteen hundred pages written by a dozen different authors in C. Gerhardt's "Manual of the Diseases of Children." It is a good move on the part of the editors of the new treatise of Henry Ashby and G. A. Wright that one of the authors is an experienced operating surgeon.

The connection of pediatrics with neurology is very intimate indeed. Many of the most interesting neuro-physiological data have been secured by our special colleagues. Thus, Soltmann's researches prove that in the new-born the inhibitory centres of the cerebral cortex are almost not

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formed at all, and that the motor and sensitive irritability increases rapidly about the fifth and sixth months. This is the time at which reflex excitability is very great. It has also been found that the inhibitory function of the cardiac nerves is but feeble in the very young. The contraction under the influence of the electric current resembles very much that which is observed in the fatigued animal, and the peripheral nerves exhibit a slight excitability only. Many other observations can be made on the infant only,—thus, for instance, those concerning the first awakening of perception. On the first or second day of life hearing is active; sight sufficiently developed to be affected by light and darkness; taste and smell exist, but are feeble, and the sense of touch is mainly demonstrable on the lips. The perception of pain is but slightly developed.

Many such special contributions to the physiology of the nervous system gathered in the young could be introduced here. I can omit that in the presence of those who know; but refer to the special works of Kussmaul, G. Darwin, and Preyer, which treat of the psychology of the infant, and to the general treatises on the physiology of the young by Alleix, Vierordt, and Vittorio Massini.

Neuropathology also owes a great many results to the observations made on infants and children. Disorders of the nervous system are very common in the young. Of all the deaths resulting from diseases of the nervous system, eighty-seven per cent. take place during the first five years of life. Their frequency is best understood by the consideration of their many causes. Many are inherited or acquired during foetal life. Others are due to the insufficiency of the protection afforded to the brain. Thus it is that any trauma, the pressure of a narrow pelvis or the forceps, a fall which in the very young produces rather a general disorder than a local lesion, leads to serious consequences. The neighboring organs, such as the *ear*, or the *scalp*, are liable to affect the brain; for that reason otitis and impetigo are dangerous processes. The very anatomical development, the increasing separation of the two cerebral substances, and the incompetency of the centres of inhibition and those of co-ordination, lead to morbid processes. Anomalies of the

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bones, such as rhachitic softening and, still more, premature ossification, interfere with the cerebral development or lead directly to serious or incurable alterations. The incomplete structure of the blood-vessels is another frequent cause of disease from mere temporary congestion to serious effusions or to extravasations. Thus we have an explanation of many of the facts unaccountable to the superficial observer only. The number of neuropathies not directly fatal is excessive in the young. Convulsions of every description, eclampsia, chorea, tetany, epilepsy (poliomyelitis), Friedreich's ataxia, gather their most copious harvest among infants and children. And again it is these on whom most of our knowledge of cerebro-spinal meningitis and cerebral meningitis has been obtained.

Neurology's sister, psychology, is indebted for much of its wealth to the study of the intellectual life of infancy and childhood. It is sufficient to refer again to the valuable and influential researches of Kussmaul, the younger Darwin, and W. Preyer. Psychiatry also has learned from the mental aberrations occurring at an early age, the more so as many of the causes of mental disease in later life must be traced back to embryological data and the morbid changes of infancy. Asphyxia of the newly-born, with its resulting effusion, extravasations, or thromboses, is a frequent cause of life-long epilepsy, stupidity, or idiocy. Diseases affecting the brain at an early period preclude the formation of ideas. The absence of inhibitory and psychomotor centres in the newly-born animal precludes the equilibrium required for a normal mental organization. The disposition to psychical disturbance resulting from individual constitution, the influences of heredity, and congenital neurasthenia can be studied at the very earliest age. The symptoms of fully-developed or imminent or future mental disease are more readily studied in the young than at more advanced age, for in the young the slightest deviations will tell. Such symptoms, which are easily recognized, are waywardness and restlessness, grimacing, convulsive twitching and convulsibility, abnormal sleep, retardation of growth, and excessive masturbation. Wherever they are found to be not the direct results of easily

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appreciated causes,—as, for instance, what I have perhaps wrongly called local chorea depending on chronic nasopharyngeal catarrh,—psychical disturbances may well be feared. They are more frequent than the reports of lunatic asylums would appear to prove. For there are but few insane children in the institutions, for obvious reasons. It is only those cases which become absolutely unmanageable at home which are intrusted to an asylum. Thus it is that we can obtain more accurate statistics of idiocy than of dementia of early years. The anatomical symptoms of degeneration, leading sooner or later to mental disorders, are studied to best advantage mostly in infants and children. Of epilepsy, which mostly starts early, it is not necessary to speak here. I shall only allude to the deformities of the cranium due to general or local premature ossification of the cranial bones and fontanelles, to the peculiarities of the position of the teeth and ears, the retraced root of the nose, the asymmetry of the head and face, due either to unilateral atrophy or hypertrophy, and the shortened base of the skull. Besides, there is the excessive number of cerebral diseases manifest at a time when the increasing growth of the organs continues to add to the acquired lesions; also trauma and insolation. Finally, the impressibility of the young is such that the causes of mental disturbance in every age—chorea, hysteria, epilepsy, anomalies of the ears, nose, and heart, the presence of helminthes, the paroxysms of malaria, the anatomical results of typhoid fever, rheumatism, erysipelas, and pertussis, and the nutritive disorders resulting from anæmia, chlorosis, and alcohol—have very much more serious results when occurring at an early age. There are some causes leading to mental disturbances which are certainly more common in the young,—viz., imitation, fear, fright, masturbation, and the protracted mistakes constantly made in regard to training and education. The over-worked brains of our school-children have been complained of in this connection as early as 1804 by Peter Frank, and will yet form the subject of a few more remarks.

The history of the embryo and fœtus finds its legitimate termination in that of the infant and child. Thus embry-

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ology, teratology, and pedology, with pediatrics, are but chapters of the same book. The scientific consideration of any one of them is impossible without that of the others. The theories of heredity and consanguinity refer equally to all. The most important changes and diseases met with in the young human being cannot be studied without the knowledge of its previous history, and the intelligent appreciation of embryology cannot be attained without the exact knowledge of its final outcome. Excessive or defective growth, arrest of development, and foetal inflammation are the heads under which a large number of anomalies of the infant can be classified. The frequent occurrence of carcinoma, sarcoma, and lipoma in the young favors Cohnheim's theory, according to which those neoplasms owe their origin to the persistence of embryonic tissue. Abnormally inverted circulation explains the acardiac monstrosity; deficiency of building material accounts for the absence in many cases of limbs or parts of limbs. The laws of duplication, including intrafoetation, are now well understood, and the gigantic growth of limbs or parts of limbs, akromegaly and macroglossia, are as important in the life of the born as they are interesting from the point of view of embryological development.

Many symptoms of rhachitis, syphilis, and hæmophilia cannot be understood except in their embryological connection. The same is valid in regard to congenitally dislocated and horseshoe kidney, and transposition of the viscera. Insufficient closure of embryonic fissures explains encephalocele, porencephaly, spina bifida, bifid uvula and epiglottis, cleft palate, lips, and cheeks, pharyngeal fistulæ, hernia, and the communications between the intestinal tract and the uro-genital organs, and the persistency and patency of the urachus.

Inflammatory processes give rise to spontaneous amputation, the adhesions of the placenta to the head, to the most severe forms of obstructions and defects in the intestine, to the stenosis of the pulmonary artery, the aorta, and the atrioventricular orifice.

I must not, however, multiply examples of the intimate correlation between embryology and the malformations and

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diseases of the child. These few instances, I believe, will suffice to show to what extent the most exact and special study of the anatomy, physiology, and pathology of the child is a connecting link between, and the safest foundation of, a number of the most important branches of medical research. Indeed, if all the teaching obtained from pedology and pediatrics could be disjoined from those branches, these latter would be stripped of their best material. Though the history of pediatrics is but a brief one, it can safely be stated that those specialties have been to a great part feeding on and been built up by the observations and investigations of men specially interested in the diseases of children. You will find, when you look over the programmes of the nine associations which now form the American Congress year after year, that topics which in future will be the legitimate province of the American Pediatric Society, have attracted much of their attention.

From the first hour of life the infant requires special study. Its diet has been a source of ever-watchful research on the part of many of the best minds. In modern times, Zweifel, Korowin, Biedert, Bouchard,—not to mention A. V. Meigs and Rotch among us,—have deserved well of the subject. Not only diet, however, and individual hygiene have been studied on the child; the most vital questions of public hygiene are also connected with pediatrics most intimately. Besides such as every thinking man is deeply concerned in, it is mainly two topics that attract attention of those who take an interest in children. I allude to the school and to constitutional diseases. My remarks to-day can be but fragmentary; still, I must not, both in the interest of our science and of human society, omit to emphasize the fact that it still appears as if our schools were establishments organized to produce near-sightedness, scoliosis, anæmia, and both physical and intellectual exhaustion. Contrary to the treatment a colt receives at the hands of its owner, human society, or the state, permits or directs that the powers of a child should be rendered unfit for its future functions, *physical, mental, and moral*, for these three are indelibly interwoven. It requires physical and mental education to fertilize the soil

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for the evolution of morals. Thus the physician, and particularly he who makes pediatrics his special study, is a pedagogue by profession. The question of school-house building and school-room furniture, the structure of bench and table, the paper and type in the books, the number of school hours for the average child and the individual pupil, the number and length of recesses, the hours and duration of intervening meals, the alternation of mental and physical training, the age at which the average and the individual child should be first sent, have been too long decided by school-boards consisting of coal-merchants, carpenters, cheap printers, and undertaught or overaged school-mistresses, not, however, of physicians. The health and vigor of the American child in early years seems, according to Bowditch, superior to those of the European. Why is the youth and maiden, particularly the latter, so inferior? Why is it that anæmia and neuroses eat the marrow of the land, and undermine the future of the country by degenerating both the workers and thinkers of the community, and the future mothers? If there is a country in the world with a great destiny and a grave responsibility, it is ours. Its self-assumed destiny is to raise humanitarian and social development to a higher plane by amalgamating, humanizing, and civilizing the scum of all the inferior races and nationalities which are congregating under the folds of our flag. Unless the education and training of the young is carried on according to the principles of a sound and scientific physical and mental hygiene, neither the aim of our political institutions will ever be reached nor the United States fulfil its true manifest destiny. That manifest destiny is not so much the political one of excluding Europeans from our continent,—North or South,—for indeed the participation of European civilization in the gradual work of removing barbarism ought to be very welcome,—but of raising the standard of physical and mental health to possible perfection, and thereby contributing to the welfare and happiness of the people.

Another subject in which, for the same reason, pedology and pediatrics are profoundly interested is that referring to constitutional and infectious diseases. Most of them belong

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to early life, and therefore interest you in this society. The vast majority of them can be avoided, mortality greatly diminished, and ill-health resulting therefrom prevented. Ninety-nine cases out of every hundred of rhachitis need not exist. Before we were overrun with the poverty-stricken population of Europe, rhachitis was hardly known among us. Unless the social position of the many be improved and the laws of hygiene understood and obeyed, it will increase until we shall be on a level with Ireland, Switzerland, and Northern Italy. Where the prevention of syphilis lies, or ought to lie, we fully know. How we could avoid dysentery and typhoid, the number of which increases with the size of tenements, the insufficiency of sewers, with the number of large summer hotels, and defective drainage, we thoroughly appreciate. Scarlatina, morbilli, diphtheria, whooping-cough, need not destroy or maim hundreds of thousands if contagion were avoided; and, unless that be done, mankind, state, town, have not performed the most rudimentary function of their existence. After all, we need not boast of our civilization, which indeed requires healing and mending both from a social and medical aspect.

If we would but concentrate our means for fighting preventable disease and death as they concentrate them in Europe for the purpose of preparing for, and carrying on, wars! If we did, we should save as many hundred thousands as they seek to destroy. If, besides, but every physician knew and appreciated his duty and his honorable vocation, which consists in preventing and curing disease, and spending his best efforts in ameliorating human existence! What, then, shall we say of those of our brethren who do not feel it below their dignity to study electricity, or to make believe they do, for the avowed purpose of supplanting the hangman?

Questions of public hygiene and medicine are both professional and social. Thus, every physician is by destiny a "political being" in the sense in which the ancients defined the term,—viz., a citizen of a commonwealth, with many rights and great responsibilities. The latter grow with increased power, both physical and intellectual. (The

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scientific attainment of the physician and his appreciation of the source of evil enable him to strike at its root by advising aid and remedies. Such increase of knowledge as the combined efforts of the members of the American Pediatric Society can result in from year to year, such interest as it can raise in its own labor, such impetus as it can give to the profession at large in the direction of special research, such power as it can exert on the instruction in pediatrics of students in the medical schools, such influence as it may have among the wealthy public with a view to establish and endow special hospitals for infants and children in proving beneficial to all branches of medicine, will be an everlasting blessing to mankind.

THE HISTORY OF PEDIATRICS AND ITS RELATION TO OTHER SCIENCES AND ARTS

THE most human of all the gods ever created by the fancy or the religious cravings of mortal man was Phœbus Apollo. It was he that gave its daily light to the awakening world, flattered the senses of the select with music, filled the songs of the bards and the hearts of their hearers with the rhythm and wonders of poetry, that inspired and reveled with the muses of the Parnassus, cheered the world with the artistic creations of the fertile brains and skilful hands of a Zeuxis and Phidias—he, always he, that inflicted and healed warriors' wounds and sent and cured deadly diseases.

In the imagination of a warm-hearted and unsophisticated people it took a god to embrace and bestow all that is most beneficent and sublime—physical, moral, and mental light and warmth; the sun, the arts, poetry, and the most human and humane of all sciences and arts, namely, medicine.

Ancient gods no longer direct or control our thoughts, feelings, and enjoyments, either physical or intellectual. The kinship and correlation of hypotheses and studies, experience and knowledge are in the keeping of the philosophical mind of man, who is both their creator and beneficiary. To demonstrate this rational affinity of all the sciences and arts, some far-seeing men planned this great Congress. The new departure—in the arrangement for it—should be an example to future general and special scientific gatherings. Indeed, some of its features were adopted by the organization committee of the International Medical Congress which was to take place at St. Louis, but was given up on account of the limited time at the disposal of the great enterprise.

Congresses are held for the purpose of comparing and guarding diversified interests. A free political life re-

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quires them for the consulting of the needs of all classes. Scientific congresses are convened to gather and collate the varied opinions, experiences and results of many men, and to create or renew in the young and old the enthusiasm of youth. Their number has increased with the modern differentiation of interests and studies. Specialization in medicine is no longer what it was in old Egypt, namely, the outgrowth of the all-pervading spirit of castes and sub-classifications, but as well the consequence as the source of modern medical progress. It is difficult, however, to say where specialization ends and over-specialization begins, or to what extent specialization in medicine is the result of mental and physical limitation or of the spirit of deepening research; or, on the other hand, of indolence or of greed; or whether, while specialization benefits medical science and art, it lowers the mental horizon of the individual, and either cripples or enhances his usefulness in the service of mankind. For that is what medical science and art are for. José de Letamendi is perhaps correct when he says that a man who knows nothing but medicine does not even know medicine. What shall we expect, then, of one who knows only a small part of medicine and nothing beyond?

Congresses in general have been of two kinds. They are called by specialists for specialists, or they meet for the purpose of removing or relieving the dangers of limitation. This is what explains the great success of international and national gatherings, such as the German, British, American, and others, and what has given the Congress of American Physicians and Surgeons with its triennial Washington meetings its broadening and chastening influence.

Nor are medical meetings the only attempts at linking together what has a tendency to get disconnected. Look at our literature. The rising interest in the history of medicine as exhibited in Europe and lately also among us, and individual contributions, such as Gomperz's great book on Greek thinkers; or even lesser productions, such as Eymin's *Médecins et Philosophes*, 1904; or the important pictorial works of Charcot, Richet, and Holländer,

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prove the correlation of medicine with history, philosophy and art.

Our special theme is the history of Pediatrics and its relations to other specialties, sciences and arts. Now Friedrich Ludwig Meissner's *Grundlage der Literatur der Pädiatrik*, Leipzig, 1850, contains on 246 pages about 7,000 titles of printed monographs written before 1849 on diseases of children, or some subject connected with pedology. Of these, 2 were published in the fifteenth century, 16 in the sixteenth, 21 in the seventeenth, 75 in the eighteenth. P. Bagellardus *de aegritudinibus puerorum*, 1487, and Bartholomeus Metlinger, "Ein vast nützlich Regiment der jungen Kinder," Augsburg, 1473, opened the printed pediatric literature of Europe. In the sixteenth century, Sebastianus Austrius, *de puerorum morbis*, Basileae, 1549, and Hieronymus Mercurialis, *de morbis puerorum tractatus*, 1583, are *facile principes*; in the eighteenth, Th. Harris, *de morbis infantum*, Amstelodami, 1715; Loew, *de morbis infantum*, 1719; M. Andry, *l'orthopédie ou l'art de prevenir et corriger dans les enfants les difformités du corps*, 1741; Nils Rosen de Rosenstein, 1752; E. Armstrong, *An Essay of Diseases most Fatal to Infants*, 1768; and M. Underwood, *Treatise on the Diseases of Children*, 1784; also Hufeland, established pediatrics as a clinical entity; while Edward Jenner, 1798, *An Inquiry into the Causes and Effects of the Variolæ Vaccinæ*, opened the possibilities of a radical prevention of infectious and contagious diseases, the very subject which, a century later, is engaging the best minds and a host of assiduous workers in the service of plague-stricken mankind.

In the United States pediatrics was taught in medical schools, or was expected to be taught, by the professors of obstetrics and the diseases of women and children. The reorganization of the New York Medical College in East Thirteenth street facilitated the creation, in 1860, of a special clinic for the diseases of the young. Instead of the united gynecologic and obstetric clinics held by Bedford, Gilman, and G. T. Elliott in their respective medical colleges, there was a single clinic for the diseases of the

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young exclusively. When the Civil War caused the College to close its doors forever, in 1865, they transferred the clinic to the University Medical College, and in 1870 to the College of Physicians and Surgeons. Meanwhile, other medical schools imitated the example thus presented. The teachers were classed amongst the clinical professors; only in those schools which are forming part of universities and are no longer proprietary establishments, a few now occupy the honored position of full professors; in a very few the professor of pediatrics is a full member of the "faculty."

In the English Colonies of America the earliest treatise on a medical, in part pediatric subject was a broadside, 12 inches by 17. It was written by the Rev. Thomas Thatcher, and bears the date January 21, 1677-8. It was printed and sold by John Foster, of Boston. The title is "a brief rule to guide the common people of New England how to order themselves and theirs in the Small-Pocks, or measles." A second edition was printed in 1702.

Before and about the same time in which American pediatrics received its first recognition at the hands of the New York Medical College, European literature furnished a new and brilliant special literature. France, which almost exclusively held up the flag of scientific medicine during the first forty years of the eighteenth century, furnished in C. Billard's *Traité des maladies des enfants nouveau-nés*, 1828, and in Rilliet's and Barthez's *Traité clinique et pratique des maladies des enfants*, 1838-43, standard works which were examples of painstaking research and fertile observation. England, which produced in 1801 I. Cheyne's *Essays on the diseases of children*, gave birth to Charles West's classical lectures on the diseases of infants and children in 1848, and F. Churchill's treatise in 1850.

The German language furnished a master-work in Bednar's *die Krankheiten der Neugeborenen und Säuglinge*, 1850-53. A. Vogel and C. Gerhardt, both general clinical teachers, gave each a text-book in 1860, Henoch in 1861; and Steffen in 1865-70 published a series of classical essays.

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The number of men interested in the study and teaching of pediatrics grew in proportion to the researches and wants of the profession at large. That is why three large and influential cyclopedias, the works of many authors, found a ready market, namely, C. Gerhardt's *Handbuch der Kinder-Krankheiten*, 1877-93; John M. Keating's *Cyclopedia of the Diseases of Children, Medical and Surgical*, 1889-90, and I. Grancher's and I. Comby's *Traité des Maladies des Enfants*, in five volumes, the second edition of which is being printed this very year.

The collective and periodic literature of pediatrics began at a comparatively early time. There was a period towards the end of the eighteenth century when the influence of Albrecht von Haller seemed to start a new life for German medical literature before it lost itself again in the intellectual darkness of Schelling's natural philosophy, from which it took all the powers of French enthusiasm and research, and the epoch-making labors of Skoda, Rokitsansky, and finally Virchow, to resuscitate it. About that early time of Haller, there appeared in Liegnitz, 1793, a collection of interesting treatises on some important diseases of children (*Sammlung interessanter Abhandlungen über etliche wichtige Kinderkrankheiten*). France followed in 1811 with a collection bearing the title "*La Clinique des Hôpitaux des enfants, et revue retrospective médico-chirurgicale et hygiénique. Publiées sous les auspices et par les médecins et chirurgiens des hôpitaux consacrés aux maladies des enfants.*" Next in order are five volumes of Franz Joseph von Metzler's *Sammlung auserlesener Abhandlungen über Kinderkrankheiten*, 1833-36. Twelve fascicles under the title *Analekten über Kinderkrankheiten oder Sammlung ausgewählter Abhandlungen über die Krankheiten des kindlichen Alters; la clinique des Hôpitaux des enfants, Redacteur en chef Vanier*, Paris, 1841; and I. Behrend and A. Hildebrandt, *Journal für Kinderkrankheiten*, which appeared regularly from 1843 to 1872. It gave way to the *Jahrbuch für Kinderheilkunde*, which has appeared in quick and regular succession from 1858 to the present time. Three series of Austrian Journals between 1855 and 1876 consisted of a dozen volumes only. They contain among other important con-

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tributions the very valuable essays of Ritter von Ritter-shayn, who deserved more recognition during his life and more credit after his death, for his honesty, industry and originality, than he attained.

Special pediatric journals have multiplied since. The United States has two, France three, Germany five, Italy two, Spain one. As long as they are taken by the profession we should not speak of over-production. I attribute their existence to the general conviction that there is no greater need than of the distribution of knowledge of the prevention and cure of the diseases of the young. The literature of pediatrics seems to prove it. Not 7,000 as before 1850, not even 70,000 titles of books, pamphlets, and magazine articles exhaust the number.

Pediatric societies have increased at the same rate. The American Medical Association and the British Medical Association founded each a section 25 years ago, the New York Academy of Medicine, 1886. The American Pediatric Society was founded in 1889, the Gesellschaft für Kinderheilkunde connected with the German Gesellschaft der Aerzte and Naturforscher in 1883, the English Society for the Study of Disease in Children, in 1900. There are pediatric societies in Philadelphia, in the State of Ohio, in Paris, Kiew, St. Petersburg, and many places, all of them engaged in earnest work which is exhibited in volumes of their own or in the magazines of the profession. If we add the annual reports of hundreds of public institutions, which are so numerous indeed that a large volume of S. Hügel, "Beschreibung sämmtlicher Kinderheilanstalten in Europa," was required as early as 1848 to enumerate them; and an enormous number of text-books of masters, and of such as are anxious to become so, and monographs, and essays, and lectures, and notes preliminary and otherwise, which fill the magazines that most of us take or see, and some of us read—we may form an idea to what extent a topic formerly neglected has taken hold of the conscience and the imagination of the medical public.

Before 1769 there was no institution specially provided for sick children. They were admitted now and then to

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foundling institutions and general hospitals. In that year Dr. G. Armstrong established a dispensary in London, which was carried on until he died. A similar institution was founded in Vienna by Dr. Marstaller, in 1784. Goelis took charge of it in 1794, L. Politzer developed it, and it is still in existence. Before the French Republic was strangled, it founded the first and largest child's hospital in Europe, the Hôpital des Enfants malades, in 1802. The Nicolai Hospital was established in St. Petersburg, in 1834, by Dr. Friedburg; the St. Anne's Child's Hospital, in Vienna, 1837, by Dr. Ludwig Mauthner; and the Poor Children's Hospital, of Buda Pesth, in 1839, by Dr. Schöpf Merei, who afterwards founded and directed the Child's Hospital of Manchester, England.

Since that time the increasing interest in the diseases of children on the part of humanitarians and of physicians and teachers has multiplied children's hospitals. Most of them are small, but they are numerous enough both to exhibit and disseminate the sense of responsibility to the sick and to the necessities of teaching. The United States has been the last country to participate in these endeavors. The mostly proprietary medical schools did not find pediatric teaching to their advantage, and it took the hearts and purses of the public a long time to be opened. The waves of humanitarianism, sometimes directed by a church, and the demands of science have finally overcome previous indolence. There are many general hospitals that gradually opened special children's wards. You find pediatric hospitals in some of the larger cities—New York, Boston, Philadelphia, Albany, St. Louis, and others. It has so happened, however, that real specialties have appealed more to the general sympathy than pediatrics. That is why the number of beds in orthopedic and other special hospitals are mostly favored. Practical teaching has not been extensive. Children's hospitals that should be used for that purpose, and that are directly connected with a medical school, are but few. It has taken the medical faculties, even of Universities, too much time to appreciate the necessity of special and well-regulated bedside teaching. In some instances lay trustees, guided

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by their medical advisers, have opened their wards before faculties have consented to open their eyes. At the present time, however, there is hardly a great medical school that does not give amphitheatre or bedside instruction, either in a children's ward of a general hospital or in a special children's or babies' hospital. To a certain extent the teaching of pediatrics in a general hospital has its great advantages. It is not a specialty like that of a special sense or a tissue. For the purpose of study it had to be segregated, but it will never be torn asunder from general medicine. Vogel and Gerhardt were both general clinicians.

The comparative anatomy and physiology, hygiene, etiology, and nosology of pediatrics have been discussed before you by one of the most prominent pediatricists of our era. It will be my privilege to explain, as far as time will permit, its relation to general medicine, to embryology and teratology, obstetrics, hygiene, and private and public sanitation, to therapeutics both pharmacal and operative, and to the specialties of otology, ophthalmology, dermatology and the motor system, to pedagogy, to neurology and psychiatry, forensic medicine and criminology, and to social politics.

Infancy and childhood do not begin with the day of birth. From conception to the termination of foetal life evolution is gradual. The result of the conception depends on parents and ancestors. Nowhere are the laws of heredity more perceptible than in the structure and nature of the child. Physical properties, virtues and sins, and tendencies to disease may not stop even with the third or fourth generation. Hamburger and Osler trace an angio-neurosis through six generations, the first case in the series being observed by Benjamin Rush. In many instances still-births, early diseases, atrophy, and undue mortality of the young depend on antenatal happenings. The condition and diet of the mother influences her offspring. The danger of a contracted pelvis, and the necessity of premature delivery may be obviated by the restriction of the diet, or even by appropriate (thyroid and other) medication of the pregnant woman. Experi-

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ence and experiment tell the same story. The continued practice of preventing conception causes endometritis. Alcoholism causes chronic placentitis, premature confinement, or still-birth. So does chronic phosphorus and lead poisoning. Fortunately, however, the usual medication resorted to during labor is rarely dangerous, for even morphine or ergot doses given to the parturient woman on proper indications affect the newly-born rarely, and chloroform anesthesia almost never.

Scanty amniotic liquor, by the prevention of free intra-uterine excursions, may cause club-foot; or close contact of the surfaces of the embryo and the membranes give rise to adhesions of the placenta and the head, to filaments and bands whose pressure or traction produces grooving or amputation of limbs, cohesion of toes or fingers, umbilical, meningeal, encephalic, or spinal hernia; not in extra-uterine pregnancy only, where such occurrences are very frequent. Even the majority of harelips and fissured palates have that origin. Arrests of development and foetal inflammation are the headings under which most of the anomalies of the newly-born may be subsumed; congenital diseases of the ear and of the heart may result from either cause or from both. Obstructions of the intestines, the rare closures of the œsophagus, the ureter, and the urethra, with hydro-nephrosis and cystic degeneration of the kidneys are probably more due to excessive cell proliferation in the minute original grooves than to inflammation.

The insufficient closures of normal embryonic fissures or grooves explain many cases of spina bifida, many of encephalocele, most of the split lips and palates, all of porencephalus, bifid uvula and epiglottis, pharyngeal and thyroglossal fistulæ, the communications between the intestinal and uro-genital tracts, and the persistency and patency of the urachus.²

² J. W. Ballantyne, in his *Manual of Antenatal Pathology and Hygiene*, 1902, has a separate chapter on the relations of antenatal pathology to other branches of study, to general pathology, to the biological sciences, such as anatomy, embryology, physiology, botany, and zoology, and to the medical, including obstetrics,

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Heredity need not show itself in the production of a fully developed disease. It exhibits itself normally either in equality or resemblances, either total or partial, of the body, or some one or more of its external or internal organs. In this way it may affect the nervous, the muscular, the osseous, or other tissues. That is why dystrophies in different forms, obesity, achondroplasia, hyperplasia, or atrophy may be directly inherited, while in other cases the disposition to degeneration only is transmitted.

Hereditary degeneracy is often caused by social influences. The immoral conditions created by our financial system make women select not the strong and hearty and the young husband, but the rich and old, with the result of having less, and less vigorous, children. Certain professions, the vocations of soldiers and mariners, and subordinate positions of employees in general, enforce complete or approximative celibacy, with the same result. The nations that submit to the alleged necessity of keeping millions of men in standing armies, are threatened with a degenerated offspring, for not only do they keep the strongest men from timely marriages, but they increase prostitution and venereal diseases, with their dire consequences for men, women, and progeny. Wars lead to the same result in increased proportion, for tens and hundreds of thousands of the sound men are slain or crippled, or demoralized. Those who are inferior and unfit for physical exertions remain behind and procreate an inferior race; those who believe with Lord Rosebery that an empire is of but little use without an imperial race will always, in the interests of a wholesome civilization, object to the untutored enthusiasm which denounces the "weakling," and the "craven cowardice" of those who believe in the steady evolution of peace and harmony amongst men, and, in sympathy with the physical and moral health of the present and future generation, will prefer the cleanly and washed sportsmanship of an educated youth to that of the mud-streaked and blood-stained man-hunter.

public health, pediatrics, medicine, psychology, dermatology, surgery, orthopedics and medical jurisprudence, finally to gynecology and neo-natal pathology.

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A great many diseased conditions cannot be thoroughly understood unless they be studied in the evolving being. Tumors are rarely inherited, but many of them are observed in early life. Lymphoma, sarcoma, also lipoma and carcinoma, and cystic degeneration, are observed at birth, or within a short time after, and seem to favor Cohnheim's theory, according to which many owe their origin to the persistence in an abnormal location of embryonic cells. This theory does not exclude the fact that congenital tumors may remain dormant for years or decades and not destroy the young.

So much on some points connected with *embryology* and *teratology*. The connection with *obstetrical practice* is equally intimate. Three per cent. of all the mature living fœtuses are not born into postnatal life this very day. To reduce the mortality even to that figure, it has taken much increase of knowledge and improvement in the art of obstetrics to such an extent that it has become possible by Cesarean section not only to save the fœtus of a living, but also of a dead mother, for the fœtus in her may survive the dying woman.

But after all, many a baby would be better off, and the world also, if it had died during labor. There are those, and not a few, who are born asphyxiated on account of interrupted circulation, compression of the impacted head, or meningeal or encephalic hemorrhage, which destroys many that die in the first week of life. Those who are not so taken away may live as the result, of protracted asphyxia only to be paralytic, idiotic, or epileptic. Many times in a long life have I urged upon the practitioner to remember that every second added to the duration of asphyxia adds to the dangers either to life or to an impaired human existence. Besides fractures, facial or brachial paralysis, cephalhæmatoma and hæmatoma of the sterno-cleido mastoid muscle, gonorrheal ophthalmia, with its dangers to sight and even life, may be daily occurrences in an obstetrician's life. All such cases prove the insufficiency of knowledge without art, or of art without knowledge, and the grave responsibility of the practical obstetrician. To lose a newly-born by death causes at least

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dire bereavement; to cripple his future is not rarely criminal negligence.

Within a few days after birth the obstetrician or the pediatricist has the opportunity of observing all sorts of microbial infections, from tetanus to hemorrhages or gangrene, and the intense forms of syphilis. Not an uncommon disease of the newly-born and the very young is nephritis. It is the consequence, in many cases, of what appears to be a common jaundice, or of uric acid infarction, which is the natural result of the sudden change of metabolism. The diverticula of the colon, as described by Hirschsprung and Osler, and what nearly 40 years ago was characterized as congenital constipation, which depends on the exaggeration of the normally excessive length of the sigmoid flexure, belong to the same class. Their dangers may be avoided when they are understood. Of the infectious diseases of the embryo and the foetus, it is principally syphilis that should be considered; amongst the acute forms variola and typhoid are relatively rare.

What I have been permitted to say is enough to prove the intimate interdependence and connection between pediatrics and the diseases of the foetus with embryology and teratology, obstetrics, and some parts at least, of social economics.

After birth there are anomalies and diseases which are encountered in the infant and child only. There are also, common to all ages, though mostly found in children, such as exhibit a symptomatology and course peculiar to them. The first class, besides those which are seen in the newly-born, is made up mostly of developmental diseases—scrofula, rachitis, chlorosis. The actual or alleged ailments connected with dentition, most forms of stomatitis, Bednar's so-called aphthæ, the ulceration of epithelial pearls along the raphe, amygdalitis, pharyngitis, adenoid proliferations, latero- and retro-pharyngeal abscesses belong here. Infectious diseases, such as variola, diphtheria, scarlatina, measles, pertussis, and tuberculosis of the glands, bones, joints, and peritoneum have been most successfully studied by pediatricists or those clinicians who paid principal attention to pedology. Meissner prints the

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titles of more than 200 actual monographs on scarlet fever published in Europe before 1848. Pleurisy and pneumonia of the young have their own symptomatology. Empyema is more frequent and requires much more operative interference.

Tracheotomy and intubation are mostly required by the young, both on account of their liability to œdema of the larynx and to diphtheria, and of the narrowness of the larynx. Of invagination, 25% occur under one year, 53% under 10. Appendicitis, sometimes hereditary and a family disease, would long ago have been recognized as a frequent occurrence in the young if it had not been for the difficulty, mainly encountered in the young, and sometimes impossibility of its diagnosis. That is what we have been taught by Hawkins and by Treves, and lately by McCosh. Operations on glandular abscesses, osteotomies, and other operations on the bones and joints, particularly in tuberculosis, and on malformations, such as have been mentioned, require the skilful hand of the operating physician in a great many instances. Omphalocele, exstrophy of the bladder, undescended testicle, spermatic hydrocele, multiple exostoses, imperforate rectum, atresia of the vagina, or an occasional case of stenosed pylorus, belong to that class, some requiring immediate operation, some permitting of delay. It is principally infancy that demands removals of angioma, which are almost all successful, and of hygroma, mostly unsuccessful, mainly when situated on the neck and resulting from obstruction of the thoracic duct sometimes connected with thrombosis of the jugular vein. Childhood requires correction of kyphosis and scoliosis, and operations for adenoids and hypertrophied tonsils, and furnishes the opportunities for lumbar puncture and laparotomy in tubercular peritonitis; also supra-pubic cystotomy, and mastoid operations. That gum-lancing is no operation indicated or permissible in either the young or adult, and not any more so in the former than in the latter, is easily understood by those who acknowledge its necessity only in the presence of a morbid condition of the gums or teeth, and not when the physiological process of dentition exhibit no anomaly. It

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scarcely ever does. Altogether operating specialists would work and know very much less if a large majority of the cases were not entrusted to them by the pediatricist, who recognizes the principle that those who are best fitted to perform it should be trusted with important medical work. So well is the seriousness and difficulty of operative procedures, as connected with diseases of children, recognized by experts, that 1,500 pages of Gerhardt's handbook are dedicated to external pathology and operations, and that special works, besides many monographs by hundreds of authors, have been written by such masters as Guersant, Forster, Bryant, Giraldès, Holmes, St. Germain, Karewski, Lanrelongue, Kirmisson, and Broca.

Ear specialists recognize the fact that otology is mostly a specialty of the young. The newly-born exhibit changes in the middle ear which are variously attributed to the presence of epithelial detritus, to the aspiration of foreign material, or to an œdema *ex vacuo* occasioned by the separation of formerly adjacent mucous surfaces. Pus is found in the middle ear of 75% of the still-born or of dead nurslings. It contains meconium, lanugo, and vernix. Aschoff³ examined 50 still-born, or such as had lived less than two hours; 28 of them had pus in the middle ears (55%). He also examined 35 infants that had lived longer than two hours; 24 had pus (70%). Evidently the latter class had been exposed to a microbic invasion. The diagnosis in the living infant is very difficult, mostly impossible, on account of the large size of the Eustachian tube, which after having admitted the infection, allows the pus to escape into the pharynx and the rest of the alimentary canal. Many of the newly-born that die with unexplained fevers perish from the septic material, or its toxins, absorbed in the middle ear or the intestines. Nor are older children exempt. Geppert (Jahrb. f. Kind., xlv, 1897) found a latent otitis media in 75% of all the inmates of the Children's Hospitals. Both latent and known otitis is often connected with pneumonia, or with pneumonia and enteritis. In individual cases it may be difficult

³ Aschoff, Z. f. Ohrenh. Vol. xxxi.

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to decide which of the two or three is the primary, which the secondary affection.

The great vascularity of the middle ear, but still more the accessibility of the funnel-like Eustachian tube in the infant, renders otitis media very frequent. Schwartz's assertion that otitis media furnishes 22% of all ear cases in general or special practice is surely correct. Besides, difficult hearing is very frequent in the young, a fact of the greatest import to pedagogy. As early as 1886 Bezold found that of 1,900 school children 25% had only one-third, and 11% of the others only one-fifth of normal hearing. The frequent affections of the nose and pharynx in the young explain these facts and exhibit the possibilities of preservation. Finally, the immature condition of the mastoid process and of the floor of the external canal is best appreciated by the practitioner, general or special, who deals with their abscesses.

Whether deafmutism is the result of consanguineous marriage cannot be definitely asserted. It is not often hereditary, quite often it appears to be the result of family alcoholism, it sometimes depends on arrest of development and foetal inflammation, but is more frequently an acquired condition. Not rarely children are affected after they have been able to speak. The majority of cases are caused by cerebral or cerebro-spinal inflammation. According to Biedert, 55% are of that class, 28% are caused by infectious diseases (cerebro-spinal meningitis, scarlatina, typhoid fever, diphtheria, also variola and measles), 3.3% by injuries, and only 2.5% are original ear affections. Thus many of the congenital cases, and most of the acquired, are preventable. More and more will our deaf-mute institutions avail themselves of this knowledge, and will learn how to teach their children not only how to read and write, but also how to hear.

Not to the same, but to a great extent, pediatrics and *ophthalmology* join hands. Infectious diseases, such as diphtheria, affect the conjunctiva and sometimes the cornea. Syphilis of the cornea, with or without chronic iritis, is the form of parenchymatous or diffuse keratitis. A frequent tumor in the eye of the young is glioma, and

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frequent symptomatic anomalies are strabismus and nystagmus—both of them the results of a great many and various external or internal causes, with sometimes difficult diagnoses.

The connection of pedology with *dermatology* is more than skin deep; some of the most interesting problems of the latter must be studied on antenatal and postnatal lines. The congenital absence of small or large parts of the surface is probably due to amniotic adhesions; seborrhea and the mild form of lichen, also the furunculosis of infant cachexia and atheroma, to the rapid development, in the second half of intra-uterine life, of the sebaceous follicles; ichthyosis, to the same and to a hypertrophy of the epidermis and the papillæ of the corium, sometimes with dilatation of their blood-vessels and with sclerosis of the connective tissue. Congenital anomalies, such as lipoma, sarcoma, nævus pigmentosus, open all the questions of the embryonal origin of neoplasms; and the eruptions on the infant surface unclose to the specialist the subject of infectious diseases. We recognize in the pemphigus of the palms and soles syphilis; in herpes, gangrene, in what I have described as chronic neurotic pemphigus, the irritable nervous system; in eczema, constitutional disturbances of the nutrition; in erythema, local irritation or intestinal auto-infection; in isolated or multiple forms ranging between hyperæmia and exudation, the effect of local irritation or the acute or chronic influence of drugs. A dermatologist who knows no embryology or pedology, a pediatricist who knows no dermatology, is anything but a competent and trustworthy medical practitioner.

The diseases of the *muscles* interest the pediatricist, the surgical specialist, the orthopædist, the neurologist, to an equal extent. Many forms of myositis are of infectious origin. Amongst the special forms of muscular atrophy it is the hereditary variety which concerns the first. The spinal neuritic atrophy, the myogenous, progressive dystrophy, including the so-called pseudo-hypertrophy, Thomson's congenital myotonia, and atrophic defects of muscles—mainly the pectoral, but also

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the trapezius, quadriceps, and others—no matter whether they are primary or myogenous (this probably always when there is a complication with progressive dystrophy), are of special interest to the neurologist. I need not do more than mention torticollis in order to prove that neither the pediatricist nor the orthopædist, nor the general surgeon can raise the claim of sole ownership.

The relations of pediatrics to *forensic medicine* are very close. Nothing is more apt to demonstrate this than the immense literature in every language on infanticide and all the questions of physiology, physics, and chemistry connected with that subject. The morographs and magazine essays of the last two centuries written on the value or the fallacy of the lung test in the dead newborn would fill a small library. Much attention has been paid by physicians and by forensic authors to lesions and fractures of the newly-born head, and to anomalies of the female pelvis causing them. Apparent death of the newly-born and the causes of sudden death in all periods of life have been studied to such an extent as to render negative results of police investigation and of autopsy reports less numerous from year to year. Most sudden deaths receiving the attention of the authorities occur in the young. There were (Wm. Wynn Westcott in Brit. M. J., Nov. 7, 1903) in England and Wales during ten years 15,009 overlain infants; in 1900, 1,774. In Liverpool, out of 960 inquests there were 143 on babies that had died of such suffocation by accident or malice aforethought; in London, in 1900, 615; in 1901, 511; in 1902, 588. In London they had annually 8,000 official inquests, one of 14 of which were on overlain infants. The etiology of sudden deaths would be far from complete, indeed the most difficult questions could not be solved except by the facilities furnished by the observations on the young. Foreign bodies in the larynx, beans, shoe-buttons, and playthings generally, even ascarides (Bouchut), bones and pieces of meat aspirated during vomiting, acute œdema of the glottis, aspiration of a long uvula, or of the retracted tongue, the rupture of a pharyngeal abscess or of a suppu-

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rating lymphoid body into the trachea, a sudden swelling of the thymus in the narrow space between the manubrium and vertebral column, which at best measures only 2.2 cm., even a coryza in the narrow nose of a small infant filled or not with adenoids—are causes of sudden death

The *nervous system* furnishes many such cases. It is true there is no longer a diffuse interstitial encephalitis, such as Jastrowitz would have it, nor is the hypertrophy of the brain by far so frequent as Hüttenbremer taught, but there are sudden collapses and deaths by falls on the abdomen, by sudden strangulation of large herniæ and other shocks of the splanchnic nerve. There are sudden and unexplained deaths in unnoticed attacks of convulsions, in the first paralytic stage of laryngismus stridulus, in glottic spasms from whatever cause, in the paralysis—or, according to Escherich, laryngo-spasm—of what since Paltauf has been denominated status lymphaticus, in cerebral anemia, no matter whether it is the result of exhaustion or, as Charles West taught us 60 years ago, from the mere change of position of a pneumonic or otherwise sick baby, when suddenly raised from its bed. Or death may occur suddenly (a very frequent occurrence) in the heart failure of parenchymatous degeneration of the heart muscle as it occurs in and after diphtheria, influenza, and other infectious diseases, or in the acute sepsis of appendicitis and other intraperitoneal affections, whether recognized or not. For the absorbing power, even of the normal peritoneum, is enormous. Of a very acute infection (“*infectio acutissima*”), Wernich spoke as early as 1883.

In gastroenteritis, the terminating broncho-pneumonia may destroy life quite suddenly; there is a capillary bronchitis of the very young with no cry, no moan, and no cough, but with sudden death; there are in extreme atrophy, fatal emboli into the pulmonary, sometimes renal, more often cerebral arteries. There are the cases of uremic convulsions, sudden, with sudden death, which are often taken to be merely reflected or “providential,” because the frequency of acute nephritis in the

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newly-born and the infant, with its fever and its uremia, in spite of the publications of Martin and Ruge, Virchow, Orth, Epstein, and my own, is not yet fully appreciated. That is so much the more deplorable as the diagnosis of nephritis at any age is readily made by the examination of the urine, which is so easy to obtain in the young. Other suddenly fatal conditions, such as the acute or chronic sepsis I mentioned before, often quite unsuspected, entering through the umbilicus, the intestine, or the middle ear, are quite frequent.

I have been careful not to mention any cause of death that may just as well be and has been studied in the adult: hemorrhages, the many forms of sepsis of later periods of life, poisons, such as carbolic acid and iodoform, intense cold or heat, insolation, etc., for it is my duty to exhibit the relation to forensic medicine of pediatrics only. Forensic medicine has to guard the interests of all. Nothing in all medicine is more difficult than the discovery of the cause of death. The best knowledge of the advanced practitioner, of the pathologist, of the chemist, of the bacteriologist, of the obstetrician, should be at the service of the people. Every European country understands that and acts on that knowledge. Our own Massachusetts has broken away from the coroner's institution, which was a fit authority for a backwoods municipality, but is so no longer for a cultured people of eighty millions. Now and then, even an expert, or a body of experts, does *not* succeed in discovering the cause of death. What shall we say of a system which *now and then does* discover the hidden cause of a sudden death? When the New York State Legislature six months ago passed a bill abolishing the no longer competent office of coroner, our good cultured mayor, a gentleman and author, vetoed it for the reason that the new law was not perfect. It was not pronounced perfect by anybody, no law is nor ever was. That is why it appears he prefers something that always was and is, and always will be perfect, namely, the absurd incompetency and anachronism of the coroner's office. That is perfect. I have not hesitated to express

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myself strongly and positively, for I have been called upon to speak to you about the relation of pediatrics to other sciences and arts—politics included, than which there is no more profound practical and indispensable science and art. The greatest historical legislators understood that perfectly well, when they knew how to blend hygiene and religion with their social and political organization.

One of the greatest questions which concerns at the same time the practical statesman, the humanitarian and the pediatricist, is that of the *excessive mortality* of the young. The Paris Academy of Medicine enumerated in its discussions of 1870 the following amongst its causes: Poverty and illness of the parents, the large number of illegitimate births, inability or unwillingness on the part of mothers to nurse their offspring, artificial feeding with improper material, the ignorance of the parents in regard to the proper food and hygiene, exposure, absence of medical aid, careless selection of nurses, lack of supervision of baby farms, general neglect and infanticide. *If there be anybody who is not quite certain about the relationship of sciences and arts, he will still be convinced of the correlation and co-operation of ignorance, indolence, viciousness and death, and shocked by the shortcomings of the human society to which we belong. Most of them should be avoided. Forty per cent. of the mortality of infants that die before the end of the first year takes place in the first month. That is mostly preventable. A few years ago the mortality of the infants in the Mott Street barracks of New York City was 325 per mille. Much of it is attributable to faulty diet.*⁴

Amongst those who believe in the omnipotence of

⁴ Measures taken for the purpose of obtaining wholesome milk are not quite new. Regulations were given in Venice, 1599, for the sale of milk. Milk and its products of diseased animals were forbidden. The Paris municipality of 1792 enjoined the farmers to give their cows healthy food. Coloring and dilution of milk were strictly forbidden, and in 1792 they knew in France how to punish transgressors.

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chemical formulæ, there prevails the opinion that a baby deprived of mother's milk may just as readily be brought up on cow's milk; that is easily disproved. In Berlin they found that amongst the cow's-milk-fed babies under a year the mortality was six times as great as amongst breast-fed infants. Our own great cities gave us similar, or slightly smaller, proportions, until the excessive mortality of the very young was somewhat reduced by the care bestowed on the milk, introduced both into our palaces and tenements. Milk was examined for bacteria, cleanliness, and chemical reaction. It was sterilized; pasteurized, modified, cooled, but no cow's milk was ever under the laws of nature changed into human milk, and with better milk than the city of New York ever had, its infant mortality was greater this summer than it has been in many years.

That hundreds of thousands of the newly-born and small infants perish every year on account of the absence of their natural food is a fact which is known and which should not exist. Why do we kill those babies or allow them to be killed? Why is it that they have no breast milk? A large number of women work in fields, still more in factories. That is why their infants cannot be nursed, are farmed out, fed artificially, with care or without it, and die. It is the mis-rule prevailing in our social conditions which compels them to withhold milk from the infant while they are working for what is called bread for themselves and their families. Many of these women, it is true, would not have been able to nurse their newly-born, for their own physical condition was always incompetent. The same may be said of women in all walks of life. Insufficient food, hard work, care, hereditary debility and disease, tuberculosis, alcoholism of the woman's own father, modified syphilis or nervous diseases in the family—aye, the inability of her own mother to nurse her babies, are ever so many causes why the mother's fountain should run dry. Statistics from large obstetrical institutions (Hegar) prove that only about 50% of women are capable of nursing their offspring for merely a few

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weeks. In the presence of such facts what are we to say of the refusal of well-situated and physically competent women to nurse their infants? I do not speak of the "400," I mean the 400,000 who prefer their ease to their duty, their social functions to their maternal obligations, who hire strangers to nurse their babies, or worse yet, who make-believe they believe the claims of the infant food manufacturers, or are tempted by their own physicians to believe that cow's milk casein and cow's milk fat may be changed into woman's casein and fat, that chemistry is physiology, that the live stomach is like a dead laboratory bottle, that the warmth of the human bosom and that of a nursing flask are identical, and that cow's milk is like human milk when it carries the trademark "Certified," or "Modified." Physiological chemistry itself teaches that the phosphorus combinations in woman's milk in the shape of nuclein and lecithin are not contained in cow's milk, and that the large amounts of potassium and sodium salts contained in cow's milk are dead weights rather than nutrients, and particularly the large amount of calcium phosphate occurs in a chemical, not in a physiological, combination. But lately, by no means the first time, Schlossmann and Muro (*Münch. med. Woch.*, 1903, No. 14), have again proved that the albuminoids of woman's and cow's milk are essentially different, both in their lactalbumin and the globulin, and Escherich and Marfan, that every milk has its own enzymes.

The quantitative and many of the qualitative differences of cows' and human milk have been known a long time. No addition or abstraction of salts, no addition of cow's fat will ever change one into the other. But it appears that every new doctor and every new author begins his own era. There is for most of modern writers no such thing as the history of medicine or of a specialty, or respect of fathers or brothers. In modern books and essays you meet with footnotes and quotations of the productions of yesterday that look so erudite, but also with the new discoveries of old knowledge which you would recognize if the quotation marks had not been

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forgotten by accident. So it has happened that many learn for the twentieth time that the knowledge of the minimum amount of required food is a wholesome thing, that the amount of animal fat in infant food is easily overstepped, that we have discovered that the Dutch had a clever notion when they fed babies on buttermilk with reduced fat; we are even beginning to learn what our old forefathers practiced a hundred years ago, and physiologists taught a third of a century ago—namely, that the newly-born and the very young infant not only tolerate small quantities of cereals but that they improve on it. Indeed, the names of Schiller, Korowin, and Zweifel have been rediscovered. We have also learned—just lately, it appears—what was always known, that morning and night, idleness and work, health and illness, while altering the chemical composition of woman's milk do not necessarily affect its wholesome character. We are beginning to learn that it is impossible to feed a baby on fanatical chemical formulæ, for they are not prescribed by Nature, which allows latitude within certain limits. We are even beginning to learn that if that were not so there would be no artificially fed babies alive, and possibly very few participants in the St. Louis Congress of Arts and Sciences.

The inability or reluctance of women to nurse their own infants is a grave matter. From a physical, moral, and socio-political point of view there is only one calamity still graver, that is to refuse to have children at all. It undermines the health of women, makes family life a commercial institute or a desert, depopulates the child world, reduces original Americans to a small minority, and leaves the creation of the future America in the hands of twentieth century foreigners. The human society of the future will have to see to it that no poverty, no cruel labor law, no accident, no luxurious indolence, must interfere with the nursing of infants. I believe in the perfectibility of the physical and moral conditions of the human race. That is why I trust that society will find means to compel able-bodied women to

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nurse their own infants. Infants are the future citizens of the republic. Let the republic see that no harm accrues from the incompetence or unwillingness to nurse. Antiquity did not know of artificial infant feeding. The first information of its introduction is dated about 1500. Turks, Arabs, Armenians, and Kurds know of no artificial feeding to-day. It takes modern civilization to expose babies to disease and extinction. I know of no political or social question of greater urgency than that of the prevention of the wholesale murder of our infants caused by the withholding of proper nutriment. May nobody, however, feel that all is accomplished when an infant has finally completed his 12 months. Society and family owe more than life—they owe good health, vital resistance, and security against life-long invalidism.

But even willing mothers may have no milk. We require a stronger, healthier race, and one that physically is not on the down grade. The nursing question is a social and economic problem like so many others, like the childbearing question, that confront modern civilization.

We are building hospitals for the sick of all classes, and insist upon their being superior to the best private residences; asylums for the insane, neuropathics, and drunkards; nurseries and schools for epileptics, cretins, and idiots; refuges for the dying consumptives; and sanatoria for incipient tuberculosis. We are bent upon curing and upon preventing. Do we not begin at the wrong end? We allow consumptives and epileptics to marry and to propagate their own curse. We have no punishment for the syphilitic and the gonorrhœic who ruins a woman's life and impairs the human race. Man, however, must see that his kind shall not suffer. One-half of us should not be destined to watch, and nurse, and support the other half. Human society and the State have to protect themselves by looking out for a healthy, uncontaminated progeny. Laws are required to accomplish this; such laws as will be hated by the epileptic, consumptive, the syphilitic, and the vicious. No laws ever suited the degenerates against whom they

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were passed, and it is unfortunate that while health and virtue are as a rule not contagious, disease and vice are so to a high degree.

Modern *Therapeutics*, both hygienic and medicinal, has gained much by the close observation of what is permitted or indicated or required in early age. Since it has become more humane (remember it is hardly a century since Pinel took the chains off the insane in their dungeons, and not more than half a century since I was taught to carry my venesection lancet in my vest pocket for ready use) and more scientific, so that whatever is outside of strict biologic methods is no longer "a system," but downright quackery—the terrible increase of the latter as a world-plague is deemed by rational practitioners and the sensible public an appalling anachronism. It appears that the States of the Union are most anxious (and have been partially successful) to rid themselves of it, while some at least of the nations of Europe are greater sufferers than we. According to the latest statistics, there is one quack to every physician in Bavaria and Saxony; ten quacks in Berlin, with its emperor and other accomplishments, to every forty-six physicians. Its general population has increased since 1879 by 61%; the number of physicians, 1702%; that of the quacks, 1600%.

One of the main indications in infant therapeutics is to fight anemia, which is a constant danger in the diseases of the young, for the amount of blood at that age is only one-nineteenth of the whole body weight, while in the adult it is one-thirteenth. The newly-born is particularly exposed to an acute anemia. His blood weighs from 200 to 250 grammes. It is overloaded with hæmoglobin which is rapidly eliminated, together with the original excess of iron. This lively metabolism renders the infant very amenable to the influence of bacteria, and the large number of acute, sub-acute, or chronic cases of sepsis is the result. Besides, the principal normal food is milk, which contains but little iron. That is why pediatrics is most apt to inculcate the lessons of appropriate posture, so as not to render the brain

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suddenly anemic, and of proper feeding and of timely stimulation before collapse tells us we are too late, and the dangers of inconsiderate depletion. The experience accumulated in pediatric practice has taught general medicine to use small doses only of potassic chlorate; large doses of strychnine and alcohol in sepsis, of mercuric bichloride in croupous inflammations, of heart stimulants, such as digitalis, when a speedy effect is wanted, of arsenic in nervous diseases, of potassic iodide in meningitis; it has warned practical men of the dangers of chloroform in status lymphaticus;⁵ it has modified hydrotherapeutic and balneological practice, and the theories of hardening and strengthening according to periods of life, and to the conditions of previous general health.

The appreciation of electricity as a remedy has been enhanced by obstetricians, pediatricists and general practitioners. It is but lately that we have been told (P. Strassmann, *Samml. Klin. Vortr.*, 1903, No. 353) that a newly-born and an infant up to the third week are perfectly insensible to very strong electrical currents. The incompetency of mere experimental work, not corrected or guided by practice, cannot find a better illustration, for there is no more powerful remedy for asphyxia and atelectasis than the cautious use of the interrupted or of the broken galvanic current.

The domain of preventive therapeutics expands with the increased knowledge of the causes of disease. That is why immunizing, like curative serums, will play a more beneficent part from year to year, and why the healthy condition of the mucous membrane of the nose, mouth, and pharynx, which I have been advising these forty years as a prevention of diphtheria, has assumed

⁵ In the meeting of the Society for the Study of Disease in Children, May 27, 1904, Mr. Thompson Walker alluded to the collection of ten cases with status lymphaticus in which death had occurred at the commencement of chloroform administration, or during it, or immediately after the operation. In addition to the usual changes, a hyperplasia of the arteries had been noted, leading to narrowing of the lumen.

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importance in the armamentarium of protection against all sorts of infectious diseases.

Amongst the probabilities of our therapeutical future I also count the prevention of congenital malformations, which, as has been shown, are more numerous than is generally known or presumed, and often the result of intrauterine inflammation. In a recent publication F. von Winckel (Samml. Klin. Vortr., 1904, No. 373) emphasizes the fact that the general practitioner or the pathologic anatomist sees only a small number, that indeed the majority are buried out of sight, or are preserved in the specimen jars of the obstetrician. The known number of malformations compared with that of the normal newly-born varies from one to thirty-six, to one to one hundred and two or more. They are met with in relatively large numbers on the head, face and neck—altogether in 53.2% of all the 190 cases of malformation observed in Munich during twenty years. A number of them is the result of heredity, of syphilis or other influences. How many are or may be the result of consanguineous marriages will have to be learned. In all such cases the treatment of the parents or the prohibition of injurious marriages will have to be insisted upon. The number of those recognized as due to amniotic adhesions or bands is growing from year to year. Kümmerl could prove that of 178 cases, 29 were certainly of that nature. External malformations have long been ascribed to them; proximal malformations, such as auricular appendices, harelip, anencephalia, cyclopia, flattening of the face, anophthalmia, hereditary polydactylia (Ahlfeldt and Zander, Virchow's Archiv, 1891), and lymphangioma of the neck, have been found to be caused by amniotic attachments or filaments. Is it too much to believe that the uterus, whose internal changes, syphilitic or others, are known to be very accessible to local and general medication, should be so influenced by previous treatment that malformations and foetal deaths will become less and less frequent?

The problem of the health and hygiene mainly of the older child refers to more than its food. The *school*

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question is in the foreground of the study of sanitarians, health departments, physicians, and pedagogues. Its importance is best illustrated by the large convention which was organized in Stuttgart, April, 1904, as an International Congress for School Hygiene. Pediatricists, pedagogues, and statesmen formulated their demands and mapped out future discussions. Rational pediatrics would consider the following questions: Is it reasonable to have the same rule and the same daily sessions for children of eight and perhaps of fifteen years, and for adolescents? Certainly not. The younger the child the shorter should be the session, the longer and more frequent the recesses. There should be no lessons in the afternoon, or only mechanical occupations, such as copying, or light gymnastics. There should be no home lessons.

The problem of overburdening was carefully considered by Lorinser in 1836, and by many since. It deals with the number of subjects taught, the strictness and frequency of official examinations, and should consider the overcrowding of school rooms. We should try to answer the question whether neuroses are more the result of faulty schooling or of original debility, heredity, underfeeding, lack of sleep, bad domestic conditions, or all these combined. In Berlin schools they have begun to feed the hungry ones regularly with milk and bread. No compulsory education will educate the starving. The child that showed his first symptom of nervousness when a nursling, the child with *pavor nocturnus*, or that gets up tired in the morning, or suffers from motor hyperæsthesia, pointing or amounting to chorea, unless relieved instead of being punished by an uninformed or misanthropic or hysterical teacher, gets old or breaks down before the termination of the school term or of school age. There should be separate classes for the feeble, for those who are mentally strong, or weak, or of medium capacity. All of such questions belong to the domain of the child's physician, the physician in general. The office of school physician is relatively new. Whatever we have done in establishing it in America

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has been preceded by countries to which we are not in the habit of looking for our models. Bulgaria and Hungary have no schools without physicians. On the other hand, Vienna has none for its 200,000 school children. It is reported that the aldermen refused to appoint one. One of them objected for the reason that the doctor might be tempted to examine the Vienna lassies too closely. His business would be, and is, to look out for the healthfulness of the school building, its lighting, warming, cleanliness, the cleanliness of the children and their health, and that of the teachers. A tubercular teacher is a greater danger to the children than these, who rarely expectorate, to each other. He would take cognizance of the first symptoms of infectious diseases, examine eyes, ears, and teeth, and inquire into chronic constitutional diseases, such as rachitis and scrofula in the youngest pupils. He might undertake anthropometrical measurements and benefit science while aiding his wards. He would be helped in all these endeavors by the teachers who must learn to pride themselves on the robust health of their pupils, as they now look for the accumulation of knowledge which may be exhibited in public examinations.

They would soon learn what Christopher demonstrated, that physical development, greater weight, and larger breathing capacity, correspond with increased mental power, joining to this the advice that a physical factor as well as the intellectual one, now entirely relied upon, should be introduced in the grading of pupils. (Charles F. Gardiner and H. W. Hoagland, *Growth and Development of Children in Colorado*.—Trans. Am. Climatological Ass'n, 1903.)

Our knowledge of the physiology and pathology of the *nervous system* of all ages would be defective without lessons derived from the fœtus and infant. Amongst the newly-born we have often to deal with arrests of development, such as microcephalus, or with that form of fœtal meningitis or of syphilitic alterations of blood-vessels which may terminate in chronic hydrocephalus. When the insufficient development of reflex

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action in the newly-born up to the fifth or sixth week has passed, the very slow development of inhibition during the first half year or more, together with the rapid increase of motor and sensitive irritability, explains the frequency of eclampsia and other forms of convulsions. Many of them require, however, an additional disposition, which is afforded either by the normal rapid development of the brain, or the abnormal hypermia of rachitis. The last 25 years have increased our knowledge considerably in many directions. Congenital or premature, complete or partial, ossification of the cranial sutures lead mechanically to idiocy, or paralysis, or epilepsy; it is a consolation, however, to know that the victims of surgical zeal are getting less in number since operators have consented to fear death on the operating table, and thoughtful surgeons have come to the conclusion to leave bad enough alone. In the very young the fragility of the blood-vessels, the lack of coagulability of the blood, the large size of the carotid and vertebral arteries, the frequency of trauma during labor and after birth, the vulnerability of the ear and scalp, contribute to the frequency of nervous diseases, which before the fifth year amounts to 87% of all the cases of sickness. Rapid exhaustion leads to intracranial emaciation and thrombosis, the so-called hydroencephaloid of gastro-enteritis. The large size and number of the lymph vessels of the nasal and pharyngeal cavities facilitate the invasion into the nerve centers of infections which show themselves as tubercular meningitis, cerebro-spinal meningitis, and polio-encephalitis, or more so, poliomyelitis, and as chorea of so-called rheumatic — mostly streptococci — origin. Nose and throat specialists, as well as anatomists, have contributed to our knowledge on these points—another proof of the intimate dependency of all parts of medicine upon one another. Now all these conditions are not limited to early life, but their numerical preponderance at that time is so great that it is easy to understand that general nosology could not advance without the overwhelming number of well-marked cases amongst

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children. Amongst them are the very numerous cases of epilepsy. They escape statistical accuracy, for many an epileptic infant or child dies before his condition is observed, or diagnosticated; a great many cases of petit mal, vertigo, dreamlike states and somnambulism, fainting, habit-chorea, truancy, imbecility, incompetency, or occasionally wild attacks of mania, or the perversity of incendiarism, or in older children religious delirium, even hysteric spells, are overlooked or perhaps noticed or suspected by nobody but the family physician; or, in the cases of the million poor, by nobody. They are cared for or neglected at home, and the seizure is taken to be an eclamptic attack due to bowels, worms, colds, and teeth, exactly like three hundred years ago.

Of equal importance in this disease to the pediatricist, the pedagogue, the psychiatrist, the judge, the statesman, no matter whether in office or a thoughtful citizen, is the influence of heredity. The old figures of Echeverria, which have been substantiated by a great many observers, tell the whole story. One hundred and thirty-six epileptics had 553 children. Of these, 309 remained alive; 78 (25%) were epileptic; how many of the 231 that died had some form of epilepsy or would have exhibited it nobody can tell. He observed a dozen cases in one family. While in his opinion 29.72% showed a direct inheritance from epileptic parents, Gowers has a percentage of 35, and Spratling, who has lived among epileptics nearly a dozen years, 66.

Epilepsy is acknowledged to be one of the causes of imbecility, or genuine idiocy. In very many instances it should be considered as the co-ordinate result of congenital or acquired changes in the skull, the brain, and its meninges, and particularly the cortex. In a single idiot institution, that of Langenhagen, 15% to 18% of the 395—668 inmates were epileptic; in another, Dalldorf, 18.5% to 24.3% of 167—344; in a third, Idstein, 36% of 101 (Binswanger, in Nothnagel, Syst. Path. u. Ther., Vol. xii, 1,310).

Its main causes are central. External irritations, worms, calculi, genital or nasal reflexes, may be occa-

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sional proximate causes. But cauterization of the nares, and still more, circumcision, and clitoridectomy prove more the helplessness or recklessness of the attendant than the possibility of a cure. The individual cases of recovery by the removal of clots, bones, or tumors, are great and comforting results, but if epilepsy and its relations are ever to disappear, it is not the knife of the surgeon but the apparatus of human foresight and justice that will accomplish it. Most of the causes of epilepsy are preventable. To that class belongs syphilis and alcoholism in various generations, rachitis, tuberculosis and scrofula, many cases of encephalo-meningitis, and most cases of otitis. A question is attributed to a royal layman, "If preventable, why are they not prevented?" If there is a proof of what Socrates and Kant said, namely, that statesmanship cannot thrive without the physician, it is contained in the necessities of epilepsy. Prevention, preventives and hygienic, medicinal, and surgical aids have to be invoked, unfortunately with slim results so far.

The influence of hereditary syphilis on the diseases of the nervous system has been studied these 20 years, both by neurologists and pediatricists. Its results are either direct—that means characteristically syphilitic—or meta-syphilitic—that means merely degenerative. Hoffmann cured a case of syphilitic epilepsy in a girl of nine years in 1712. Plenck describes convulsions and other nervous symptoms depending on hereditary syphilis, and Nil Rosen de Rosenstein describes the same in 1781. The literature of the later part of the eighteenth, and of the first half of the nineteenth century is silent on that subject, though the cases of affections of the nervous system depending on hereditary syphilis are very frequent (thirteen per cent. of all the cases, according to Rumpf *die Syph. Erk. d. Nervensystems*, 1889). Jullien (*Arch. Gén.*, 1901) reports 260 pregnancies in 43 syphilitic matrimones. Of the children, 162 remained alive. Half of them had convulsions or symptoms of meningitis.

According to Nonne (*Die Syph. d. Nervens.*, 1902) hereditary syphilis differs from the acquired form in

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this—that several parts of the nervous system are affected simultaneously; and that arteritis, meningitis, gummata, and simple sclerosis occur in combination. Simple cerebral meningitis and apoplexies are very rare. Encephalitis is more frequent. Probably spinal diseases are more frequent, according to Gilles de la Tourette, Gasne, Sachs, and others. *Tabes dorsalis* is not frequent, but may rather depend on an atavistic syphilitic basis; for altogether the nerve syphilis of the second previous generation as a cause of disease in the young is not very rare. (E. Finger, *W. klin. Woch.*, 13, 1900.)

What we call neuroses are not infrequent in infants and children. Neuralgias are not so common as in the adult, but would be more frequently found if sought for. Even *adipositas dolorosa* has been observed in childhood. Hysteria is by no means rare, and its mono-symptomatic character, so peculiar to early age, adds to its nosological importance. Its early appearance is of grave import. Its often hereditary origin makes it a serious problem, under-alimentation or ill-nutrition, rachitis and scrofula, frequently connected with and underlying it, may make it dangerous and a fit subject for the study of educators, psychologists, judges, and all those whose direct office it is to study social and socialistic problems. Hysteria is not quite unknown amongst males, though the large majority are females.

Some of the vaso-motor and trophic disturbances are less, others more frequent, in the young than in the adult. Amongst 129 cases of *akroparæsthesia* there is only one of Frankl Hochwart in a girl of 12 years, and one of Cassirer in a girl of 16. *Sclerodermia* is met with mostly in mature life, but the cases of Neumann at 13 days, and those of Cruse, Herxheimer, and of Haushalter and Spielmann, who observed two cases in one family, all of them when the infants were only a few weeks old, prove that the same influences which are at work in advanced age, namely, hereditary disposition, neuropathic family influence, low general nutrition, colds, trauma, and so on, may play their rôle in infant life. Nor are infant *erythromelalgias* numerous. Henoch

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saw one in a teething infant, Baginsky in a boy of 10, Heimann one in a girl of 13, Graves one in a girl of 16; that means three or four cases below 13 or 16 years of age, out of a number of 65 collected by Cassirer in his monograph. (Die Vasomotorisch-trophischen Neurosen, Berlin, 1901.) In half a century I have seen but one that occurred in early age, namely, in a boy of 12, who got well with the loss of two toes. On the other hand, the symmetrical gangrene of Raynaud and acute circumscribed oedema of Milton and Quincke, 1882, treated of by Collins in 1892, are by no means relatively rare in infancy and childhood. There are a few cases of the former that occurred in the newly-born. Two I have seen myself. There are those which have been observed at 6 months (Friedel), 9 months (De France), at 15 months (Bjering), at 18 months (Dick). In the year 1889 Morgan collected 93 cases, 13 of which occurred from the second to the fifth, 11 between the fifth and tenth, and 15 between the tenth and twentieth years. Amongst the 168 cases collected by Cassirer, 20 occurred under the fifth, 8 between the fifth and tenth, and 25 between the tenth and twentieth years of life. Like most nervous diseases, these cases had either congenital or acquired causes, amongst which a general neuropathic constitution, and the hereditary influence of alcohol, chlorosis, and anemia are considered prominent. Of acute circumscribed oedema, 28 cases are found below nine years of age in Cassirer's collection of 160 cases, one of which at the age of one and a half months is reported by Crozer Griffith, one at three months by Dinckelacker. Again hereditary influence is found powerful. Osler could trace the disease through five generations.

The connection of pediatrics with *psychiatry* is very intimate. Insane children are much more numerous than the statistics of lunatic asylums would appear to prove, for there are, for obvious reasons, but few insane children in general institutions. It is only those cases which become absolutely unmanageable at home that are entrusted to or forced upon an asylum. The example of the French, who more than 50 years ago had a

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division in the Bicêtre for mentally disturbed children, has seldom or not at all been imitated. Thus it happens that though not even a minority of the cases of idiocy become known, its statistics is more readily obtained than that of dementia of early life. Some of its physical causes or accompaniments have been mentioned— asphyxia with its consequences, ossification and asymmetrical shape of the cranium, accidents during infancy and childhood, neuroses that may be the beginning or proximate causes of graver trouble. Infectious diseases play an important part in the etiology of intellectual disorders. Althaus collected 400 such cases. They were mainly, influenza 113, rheumatism 96, typhoid fever 87, pneumonia 43, variola 41, cholera 19, scarlatina 16, erysipelas 11. In most of the cases there were predisposing elements, such as heredity and previous diseases, or over-exertion of long duration. The over-worked brains of school children were complained of as adjuvant causes of lunacy by Peter Frank as early as 1804. We are as badly off or worse, a hundred years later.

There is one ailment, however, that appears to hurt children less than it does adolescents or adults, that is masturbation. There are those cases, fortunately few, which depend on cerebral disease, and original degeneracy, but in the large majority of instances masturbation, frequent though it be, has not in the very young the same perils that are attended with it later on when the differentiation of sex has been completed and is recognized. Babies under a year, and children under 8 or ten will outlive their unfortunate habit, and do not appear to suffer much from its influence. Whatever is said to the contrary is the exaggeration of such as like to revel in horrors. The same exorbitant imagination is exhibited in other statements. What Lombroso and his followers have said of the faulty arrangement of the teeth, prognathic skulls, retracted nose, short and attached lobes of the auricle, as distinct symptoms of mental degeneracy, belongs to that class, and need not always be taken as the positive signs of insane crimi-

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nality. There is so much poetical exaggeration and word painting in them that Lombroso and also Krafft-Ebing are the pets of the prurient lay public. In its midst there must be many who are anxious to believe with Lombroso that brown hair and eyes, brachycephalic heads, and medium size of the body characterize the insane criminal, if only for the purpose of scanning the hair and eyes and heads of their near friends and their mother-in-law's relatives.

It is certainly not true that, as Lombroso will have it, children are cruel, lazy, lying, thievish, just as little as according to him all savages are like carnivorous animals, and essentially criminal, while others are convinced that by nature they are amiable, like Uncas, and virtuous like Chingacook, and have been rendered savage only by the strenuousness of conquering immigrants. Nor is it true that the idiot brain is merely arrested at a stage similar to anthropoid, or even saurian development, for it is less arrest of development than the influence of embryonal or fœtal disease, beside amniotic anomalies that cause the irregularities of the encephalon.

Amongst the worst causes of idiocy is cretinism, both the endemic, and the sporadic. Every cretin is an idiot, not vice versa. The first could be prevented by State interference which would empty the stricken valleys; the latter depends on thyroidism, with or without a shortening of the base of the skull, and is partially curable. The idiotism of cretinism causes a fairly uniform set of symptoms; that which depends on other causes exhibits varieties, though not so many as imbecility, which, too, should not be taken to be the result of a single cause. Osseous and cartilaginous anomalies about the nose are pointed out by William Hill, chronic pharyngitis and nasal polypi by Heller, enlarged tonsils by Kafemann in one-third of the cases, some pharyngeal or nasal anomaly in four-fifths by Schmid-Monnard. Adenoids are frequently found as complications. Operations to meet all these anomalies have been performed with improvement of the mental condition in some, of the physical in many more, mainly when the anomalies

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were complications only. But after all we should beware of the belief in miracles and in infallible cures. Mainly the tonsils have been puffed up to be the main causes of many human troubles and their removal a panacea. According to a modern writer it prevents tuberculosis, but the prophet is a little too bold, for he adds that with the exception of himself there are very few able to accomplish it. Defective or diseased brains are frequent in most conditions. The former class allows even imbeciles to excel in some ways. In that class may be found calculating experts, chess-players, or mechanical draughtsmen.

Imbecile persons may be taught sufficiently to prepare for the simple duties of life. There are, however, many transitions between the complete imbecile, the mild imbecile, and the merely slow and dull. That is why the condition is frequently not appreciated. In his school the imbecile child is slightly or considerably behind his class, and the laughing-stock of the rest. As he is intellectually slow, so he is morally perverse or is made to become so. He knows enough to lie and libel, to run away from school, and from truant to become a vagrant. It is true it will not do to declare the imbecile *per se* identical with the typical criminal, but as many of them are illegitimate, or of defective or alcoholic parents, or maltreated at home, or diseased and deformed, they get, by necessity, into conflict with order and the law. Thompson found 218 congenital imbeciles among 943 penitentiary inmates. Knecht, 41 amongst 1,214. When the imbecile is once a prisoner his condition is not liable to be noticed on account of the stupefying monotony of his existence.

What is more to be pitied, the fate of the immature or imbecile half-grown child that naturally acts differently from the normal, or the low condition of the State which instead of procuring separate schools for the half-witted, or asylums, has nothing to offer but contumely and prison walls, and increasing moral deterioration? There is the stone instead of the bread of the gospel.

Modern society has commenced, however, to mend old injustices. Every civilized country admits irresponsibility

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before the law below a certain age, and gradually the mental condition of the criminal is taken into consideration and made the subject of study. But still thousands of children and adolescents are declared criminals before being matured. The establishment of children's courts is one of the things, imperfect though they be, that make us see the promised land from afar. When crime will be considered an anomaly, either congenital or acquired in childhood, a disease; when society will cease to insist upon committing a brutality to avenge a brutality; when self-protection will take the place of revenge, and asylums that of State prisons—then we shall be a human, because humane, society.

CONCLUSIONS

Pedology is the science of the young. The young are the future makers and owners of the world. Their physical, intellectual and moral condition will decide whether the globe will be more Cossack or more Republican, more criminal or more righteous. For their education and training and capabilities, the physician, mainly the pediatricist, as the representative of medical science and art, should become responsible. Medicine is concerned with the new individual before he is born, while he is being born, and after. Heredity and the health of the pregnant mother are the physician's concern. The regulation of labor laws, factory legislation, and the prohibition of marriages of epileptics, syphilitics, and criminals are some of his preventive measures to secure a promising progeny. To him belongs the watchful care of the production and distribution of foods. He has to guard the school period from sanitary and educational points of view, for heart and muscle and brain are of equal value. It is in infancy and childhood, before the dangerous period of puberty sets in, that the character is formed, altruism inculcated, or criminality fostered. If there be in the commonwealth any man or any class of men with great possibilities and responsibilities it is the physician. It is not enough, however, to work at the individual bedside and in a hospital. In the near or dim future, the pediatricist, the physician,

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is to set in and control school boards, health departments, and legislatures. He is the legitimate adviser to the judge and the jury, and a seat for the physician in the councils of the republic is what the people have a right to demand. Before all that can be accomplished, however, let the individual physician not forget what he owes to the community now. Mainly to the young men amongst us I should say, do not forget your obligations as citizens. When we are told by Lombroso that there is no room in politics for an honest man, I tell you it is time for the physician to participate in politics, never to miss any of his public duties, and thereby make it what sometimes it is reputed not to be in modern life—honorable. A life spent in the service of mankind, be our sphere large or narrow, is well spent. And never stop working. Great results demand great exertions, possibly sacrifices. After all, whether everything in science and politics that now is our ideal will be accomplished while we live or after we shall be gone, we shall still leave to our progeny new problems.



THE HISTORY OF CEREBRO-SPINAL MENINGITIS IN AMERICA

NOTHING is more difficult to ascertain than the age of certain diseases, which by reason of their distribution and mortality have attained historical significance. The most notable in the category is syphilis. The number of people who believe it to have sprung from nihility at the close of the fifteenth century, or who consider it an article of importation by the immoral Indians from Indianola into blissful, innocent Spain, has not diminished. Most likely cerebro-spinal meningitis will fare the same fate.

What we call cerebro-spinal meningitis to-day was first described, with certainty, in 1805. Lersch cites, in a short note, also the year 1803 (*Volksseuchen*, 1896), but gives no data of the literature. In all probability this disease existed, either sporadically or endemically, at an earlier period. Meredith Clymer (*Epidemic Cerebro-Spinal Disease*, Phil. 1872) gave expression to his presumption that occasional cases with a similar symptom-complex had been observed in the United States toward the end of the eighteenth century.

The malignant fever which Daniel Sennert describes in 1611 is most likely one and the same disease, and later was characterized as spotted fever, cerebro-spinal typhus, cerebro-spinal fever and cerebro-spinal meningitis. According to Webber (Boylston Prize Essay in *Boston Med. and Surg. Jour.* 1866), from the thirteenth century onward, symptoms descriptive of cerebro-spinal meningitis have been enumerated. The accounts have not always been accurate, the principal symptoms have been variously depicted; it is quite likely that our disease and exanthematous typhus were often mistaken for one another, like syphilis, which before the end of the fifteenth century was often, if not always, confounded with measles and variola

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(J. K. Proksch, *Beiträge zur Geschichte der Syphilis*, 1904). Sir John Pringle, in 1752, wrote, in his observations on diseases of the army, about a prison and hospital fever in which pus was found on the brain, and Bascome in his history of epidemic pestilences, London, 1851, refers to a local epidemic, in Roettingen, Bavaria, in 1802, in which young, strong males, with painful stiffness of the muscles of the neck, died within twenty-four hours.

The best history of cerebro-spinal meningitis of all countries is to be found in the third volume of *Historisch-Geographische Pathologie* by August Hirsch, 1886. The "Epidemic Cerebro-Spinal Meningitis and its relation to other forms of meningitis—a report of the State Board of Health of Massachusetts, Boston, 1898," by W. T. Councilman, F. B. Mallory and J. H. Wright, offers valuable contributions. That part of the second volume of Puschmann's *Geschichte der Medicin*, edited by Victor Fossel, is quite superficial. The Subject Catalogue and Index Medicus contain naturally everything desirable, and much that is not so.

The great knowledge revealed in our periodical literature is collected with the aid of a secretary from the above named sources, from Virchow-Gurlt's *Jahresbericht* and other encyclopædiæ. Without quoting these works too much I will give you a short survey of the occurrence of cerebro-spinal meningitis in the United States, which more often than any other country has been invaded by this plague. Hirsch divides its history into four periods 1805-1837; 1837-1850; 1854-1875; 1876 up to the time that his book was published—we may say, with interruptions, until to-day. In the first, third and fourth periods the United States was severely affected, whereas during the second period France bore the brunt of the disease. It is to be hoped that the period we have been going through since last year is not the precursor of a fifth period. In 1806 the disease was epidemic in New Hampshire, Massachusetts, Connecticut, New Jersey and Vermont; in 1807 in Canada; in 1808 in Virginia, Kentucky and Ohio; 1809 in New York and Pennsylvania; 1814 in Maine; 1814-1816 in New England in general. The epidemic then gradu-

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ally died out. However, in 1823 we hear again of an epidemic in Middletown, Conn., and in 1828 in Trumbull, Ohio. From then until 1842 we have no data.

The most important contributions to the literature are by L. Danielson and E. Mann (1806), "A singular and very fatal disease which lately made its appearance in Medford, Mass.," which appeared in the *Medical and Agricultural Register*, Boston; further, a contribution by a committee of the Massachusetts Medical Society (James Jackson, Thomas Welch and J. C. Warren) of the year 1809, printed in 1813 in the second volume of the *Transactions*; and above all, the book of Elisha North of 1811, which is worthy of the name of a classic. The title of this book which contains 249 pages is: "A Treatise on a Malignant Epidemic Commonly Called Spotted Fever, etc."

Dr. North's book contains among other things the history of the epidemic of Litchfield county, Connecticut, by Dr. Samuel Woodward of Hartford, besides a good description of the clinical picture of the disease by Dr. Berton. Under the influence of Brownianism, which did not prevail in England, although it was prevalent in Germany and America, he sought the immediate cause of the disease "in the increase in the sensorial power of sensation with the decrease of the sensorial power of irritation." Whoever cannot understand this, must console himself with the fact that during the following 30 or 40 years, medicine in Germany, for instance, was an absolute blank, with indescribable buncombe, and we may indeed congratulate ourselves that we have outlived the era of the Systems. During the second period (according to Hirsch) the disease was very widespread with us, from 1842-1850; in 1842 in Rutherford county, Tennessee, and in Montgomery, Alabama; in 1845 in Mt. Vernon, Illinois; in 1846 and 1847 in Arkansas; in 1847 in Vicksburg, Mississippi, in Tennessee and in Missouri. The disease was especially virulent among the recruits of a regiment that had been sent from Mississippi into swampy quarters near New Orleans. In 1848 Montgomery, Alabama, was affected for the second time; also Pennsylvania along the

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Ohio river and Worcester, Massachusetts. In 1850 there was a severe epidemic in the negro quarters of New Orleans, as we find it among populations who live in wretched hovels with insufficient nourishment.

From 1850-1856 the United States were free from the disease. In 1856 and 1857 we find it in Salisbury, North Carolina (Dickson in *Trans. A. M. A.*); in the same year it prevailed in the western part of New York, especially in Onondaga, Chemung and Madison (Thomas in *Trans. Med. So. St. of N. Y.*). During the war, 1861-1864, the disease was far reaching. In the winter of 1861-1862 it existed in the Army of the Potomac near Washington; likewise in a negro colony quartered by the Confederates in Memphis. In 1862 and 1863 it appeared in the camp around New Bern, N. C., with the same clinical and anatomical manifestations which had been observed in 1810; and also in Massachusetts in 1864 and 1865. Massachusetts then remained free from the disease until it appeared in Boston in 1872 and 1873 (J. B. Upham in *Report of the State Board of Massachusetts*, 1874). It had appeared in Philadelphia in 1863. This epidemic was described in 1867 by Alfred Stillé in a monograph which has retained its value, entitled "Epidemic Meningitis." The same author published an article in 1885 in Pepper's *System of Medicine*, which is still very instructive.

During the epidemic which prevailed at Philadelphia in 1863-1866, the whole city was severely affected; also Indiana and Iowa; and likewise the Confederate troops in Norfolk, Va., whose camps were pitched in swampy regions, and those who were in hospitals. At this time the disease appeared for the first time at the military school in Newport, R. I. Mobile, Ala., Illinois, New Jersey, Vermont along the Connecticut river, Connecticut and Ohio were severely affected. There were bad epidemics in two hospitals and in the orphan asylum at Washington.

→ From 1860-1874 we find epidemics over the entire length of the land, especially during the winter and spring. After 1876 the disease showed itself sporadically at far separated points. In 1893 the disease once more became epidemic in New York (H. Berg in *Archiv. Ped.* May,

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1894). This author emphasizes the non-contagious nature of the disease. It also appeared in the Layaconing Valley in Maryland in 1893. Simon Flexner and Lewellys J. Barker in the *Amer. Jour. of the Med. Sc.* (February and March, 1894) describe this epidemic from a practical and strictly scientific standpoint. Appended to this article there is a two-page bibliography of the most valuable essays on this subject. In some of their cases the pneumococcus was found.

During these decades the disease did not die out. Occasionally for long periods the mortality was low; then suddenly it would rise. For instance, during many years only isolated cases developed in Montreal; so also in the Boston City Hospital, from 1880 to 1896, only 39 cases died. But during the first month of the epidemic of 1897 there were 42 fatal cases. Stillé reports but few cases in Philadelphia from 1864-1865, and from 1872-1873. Pepper carries the report along until 1892 and Abbott brings it up to date. How rapidly the mortality changes will be seen from the following figures: Philadelphia had in 1884, 124 deaths; in 1893, 23 deaths; in the succeeding years seriatim, 22, 35, 18, 17, 7, 10; 24 in 1898, and in the first 4 months of 1899, 89 deaths.

In New York the disease was endemic in 1867-1868 (Brown, *Med Record*, April, 1868). Somewhat later, Ohio and Indiana were affected; between 1869 and 1870 we find the disease reappearing in Alabama, Pennsylvania, and Virginia, in 1871 in Minnesota and Pennsylvania, in 1872 in New Jersey, the cities of New York and Brooklyn, Onondaga county, also Illinois, South Carolina and part of Georgia. Concerning Augusta, Ga., I was kept informed at that time by Dr. Ford. The cases were not numerous but fulminating, and occurred almost exclusively among the most miserable class of negroes. In 1873 Massachusetts suffered severely, Indiana and Michigan to a less extent.

Children were chiefly affected during 1806 in Massachusetts, 1847 in Tennessee, 1857 in Elmira, 1863 in Philadelphia, 1864 in Illinois, 1870 in Virginia. Adults between 20 and 30 years were chiefly affected in 1811 in

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Milford, Conn., in 1848 in Montgomery, Ala., and in 1857 in Brookfield, N. Y. Out of 2909 cases reported from Massachusetts 405 occurred in the first nine months of 1897. Of these there were 316 under one year, 146 between one and two years, 26 per cent.

I herewith present a list compiled by the New York Board of Health. In considering it, the increase of population from 1866 to 1904 must be taken into account.

	Cerebro-spinal meningitis.	Tubercular meningitis.	Simple meningitis.	Population.	Cerebro-spinal meningitis.	Tubercular meningitis.	Simple meningitis.
1866.....	18	588	486	767,979	.23	7.66	6.33
1867.....	33	654	674	808,489	.40	8.09	8.34
1868.....	34	627	820	851,137	.39	7.39	9.63
1869.....	42	688	725	896,034	.47	7.68	8.09
1870.....	32	812	750	943,300	.34	8.61	7.95
1871.....	48	755	623	955,931	.50	7.90	6.52
1872.....	782	770	848	968,710	8.07	7.95	8.75
1873.....	290	682	666	981,671	2.95	6.95	6.78
1874.....	158	627	563	1,031,607	1.53	6.08	5.46
1875.....	146	599	643	1,044,396	1.40	5.74	6.16
1876.....	127	613	697	1,075,532	1.18	5.70	6.48
1877.....	116	514	556	1,107,597	1.05	4.64	5.02
1878.....	97	604	569	1,140,617	.85	5.29	4.99
1879.....	108	609	536	1,174,621	.92	5.18	4.57
1880.....	170	617	582	1,209,196	1.41	5.10	4.82
1881.....	461	675	764	1,244,511	3.70	5.42	6.14
1882.....	238	659	714	1,280,857	1.86	5.15	5.57
1883.....	223	541	719	1,318,264	1.69	4.10	5.45
1884.....	210	683	797	1,356,764	1.55	5.03	5.87
1885.....	202	639	844	1,396,388	1.45	4.58	6.04
1886.....	223	721	872	1,437,170	1.55	5.02	6.07
1887.....	203	621	952	1,479,143	1.37	4.20	6.44
1888.....	173	493	914	1,522,341	1.14	3.24	6.00
1889.....	145	543	839	1,566,801	.93	3.47	5.36
1890.....	136	556	856	1,612,559	.84	3.45	5.31
1891.....	189	583	932	1,659,654	1.14	3.51	5.69
1892.....	230	605	1,020	1,708,124	1.35	3.54	5.97
1893.....	469	607	1,160	1,758,010	2.67	3.45	6.60

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	Cerebro-spinal meningitis.	Tubercular meningitis.	Simple meningitis.	Population.	Cerebro-spinal meningitis.	Tubercular meningitis.	Simple meningitis.
1894.....	213	598	926	1,809,358	1.18	3.31	5.12
1895.....	204	585	871	1,873,201	1.09	3.12	4.65
1896.....	178	511	784	1,906,139	.93	2.68	4.11
1897.....	232	517	755	1,940,553	1.20	2.66	3.89
1898.....	258	593	782	1,976,572	1.31	3.00	3.96
1899.....	287	609	742	2,014,330	1.42	3.02	3.68
1900.....	201	585	544	2,053,979	.98	2.85	2.65
1901.....	201	501	596	2,095,686	.96	2.39	2.84
1902.....	190	571	633	2,139,632	.88	2.67	2.96
1903.....	195	566	448	2,186,017	.89	2.59	2.05
1904.....	1,083	470	588	2,235,060	4.85	2.10	2.63

Absolute figures, however, prove nothing; relative ones much more; *e. g.* in 1866 the population of New York was 767,979; in 1904 it was 2,235,060. You will notice that, besides, the errors of another kind are not excluded. The cerebral diagnosis of many doctors who fill out death certificates are often inaccurate. This list contains as causes of death, cerebro-spinal, tuberculous and "simple" meningitis. In the first six years 1866-1871 the percentage of deaths from cerebro-spinal meningitis was very low, in the first year 23-100 of the total number of deaths. Then we find a sudden increase in 1872 to 8.07 per cent.; 1873, 2.95 per cent.; 1874, 1.53 per cent.; 1875, 1.40 per cent. Then there followed a gradual decrease. In 1880 we find it rising again to 1.41; 1881, 3.70; from 1882 to 1888 the mortality varied from 1.86 to 1.14. In 1891 it rose again to 1.14; 1892, 1.35; 1893, 2.67; 1894, 1.18; 1895, 1.09; 1896, 0.93; 1897, 1.20; 1898, 1.31; 1899, 1.42; 1900 and 1901, under one per cent.; 1902 and 1903 under 0.90; 1904 it again rose to 4.85. Please notice that the mortality percentage during 1904 did not reach double that of 1893, and that it is only a little more than half as large as during the epidemic of 1871. However, the 782 deaths of the year 1872 are much more terrible (in a population

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of less than one million) than the 1083 deaths of the year 1904 with a population of $2\frac{1}{4}$ million.

For comparison I present to you the list of deaths of the past three months of 1905, again from the official figures. In 1905 there died in Manhattan, not in Greater New York:

	Cer. Sp. Men.	Mening.	Tub. Men.
In January.....	94	144	40
In February.....	139	179	36
In March.....	295	259	37
	528	582	113

You will notice that the alleged increase of deaths due to simple meningitis has been doubled in two months. One cannot but surmise that many of these cases may have been those of cerebro-spinal meningitis. On the other hand we must not forget that during an epidemic many deaths are wrongly attributed to the disease then prevalent. The above figures are increased from 10 to 12 per cent. by including all the cases occurring in Greater New York.

The following list proves this clearly:

	Greater New York.			Manhattan.			Bronx.		
	M.	F.	Total.	M.	F.	Total.	M.	F.	To.
1898.....	201	156	357	131	114	245	9	4	13
1899.....	223	171	394	150	111	261	13	13	26
1900.....	174	132	306	103	75	178	15	8	23
1901.....	152	115	267	92	81	173	18	10	28
1902.....	145	120	265	96	78	174	7	9	16
1903.....	151	120	271	100	73	173	9	13	22
1904.....	759	642	1,401	532	471	1,003	51	29	80

	Brooklyn.			Queens.			Richmond.		
	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.
1898.....	52	30	82	9	5	14	..	3	3
1899.....	52	30	94	5	4	9	3	1	4
1900.....	50	43	93	4	4	8	2	2	4
1901.....	37	20	57	5	3	8	..	1	1
1902.....	33	24	57	4	7	11	5	2	7
1903.....	31	26	57	8	10	16	3	1	4
1904.....	147	128	275	20	9	29	9	5	14

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We find the largest mortality from cerebro-spinal meningitis in Manhattan in the 4th, 5th, 6th, 7th, 8th and 14th wards. These are the wards in which we meet, besides other social atrocities, the largest number of dark rooms, of which there were two years ago in Manhattan 212,615, in Brooklyn 139,928, in Queens 8,666 and in Richmond 452.

Of the cases under 15 years of age there died of cerebro-spinal meningitis in New York:

1895.....	167		
1896.....	157		
1897.....	201	In Greater New York. All ages.	
1898.....	210	301	357
1899.....	232	326	394
1900.....	153	251	306
1901.....	165	221	267
1902.....	156	221	265
1903.....	158	225	271
1904.....	805	1056	1401

The proportion of children that died compared with the number of deaths in Manhattan is accordingly as 805:-1003; and for Greater New York as 1056:1401. That is to say that in the boroughs outside of Manhattan the mortality among adults was higher than among children. Everywhere, however, the large majority of cases are children.

Distribution. The disease occurs in the temperate and sub-tropical zones and is therefore adapted to the United States. It is found most frequently in the winter and spring. Of 85 epidemics occurring in North America, there were 37 in the winter, 18 in the winter and spring, and 23 in the spring. Low temperatures and the presence of catarrhal disease are mentioned. However, we find the disease even in mild winters, *e. g.*, 1862 in Connecticut and 1866 in Kentucky. Many similar ones are referred to by Hirsch (pages 398 and 399). On the other hand, during some very cold winters we find only *one* city or region, *one* class of people, or *one* regiment of soldiers, affected. According to Frothingham in 1861-1862 one regiment that

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was particularly well quartered was afflicted with meningitis, while other regiments suffered from malaria.

The epidemic character of the disease has been too frequently observed to be questioned. Occasionally it appears sporadically. About 30 years ago there were two parts of New York where the disease was very prevalent, the neighborhood of Chatham Square, James and Oliver streets, and the neighborhood south of West Houston street and west of McDougall street. At that time I saw two fatal cases within one week in a room in Charlton street. The one case was a baby of 6 months that died in 8 hours, the other a child of 2 years that died in 20 hours. The autopsy in one case showed the usually prevalent fibrinous exudate. Different authors have different views concerning the spread of the disease, especially direct contagion. Viusseux, who described the Geneva epidemic of 1805, declared the disease to be non-contagious. He gave as his reason for this belief the fact that when two cases occurred in one family, they developed at the same time. North states in his book of 1811 that travelers who came from an immune place to an infected one contracted the disease. He attributed it either to contagion or to local influences. According to Hirsch, in the first large epidemic in Franken the disease spread in a regular course from northeast to southwest. Love reports that in 1847 only one regiment in New Orleans was affected. One French regiment, in which meningitis was prevalent in 1840, was transferred to Algiers. After a short time natives also were afflicted, the only time that the disease was ever observed in North Africa. During our war meningitis developed in public institutions after an infected regiment had been quartered in the city. Nowlin in the *Jour. of the Am. Med. Assoc.*, 1891, reports five cases in Shelbyville, Tenn., of which two developed in one house. Such occurrences are not isolated. Hence it is not of much moment when occasionally an observer, as for instance H. Berg. (*Arch. Pediatrics*, 1894), reports that he never observed two cases in one house. I have had no personal experience of contagion in any of my hospital services. However, last week a nurse at the Harlem Hospital, who

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had taken care of meningitis cases, died of the disease. In like manner, Dr. Craig of Philadelphia died a martyr to his duty. In 1904 most of my hospital cases suffered from nasal catarrh; in many cases the coccus was found in the secretion, in one case also in the conjunctival secretion. No infection of other patients in the ward was observed. Whether, as in malaria and yellow fever, an intermediary agent of infection such as the mosquito is required, or as in recurrent fever the bedbug, remains to be proven.

Dr. E. G. Janeway had the following experience: The coffin containing the body of a woman who had died of cerebro-spinal meningitis was opened, and a strand of her hair cut off. This strand was taken home by a woman, and frequently handled by her as well as by a child living in the same house. Both this woman and the child developed meningitis, and nobody else in the house was affected.

In the United States a disproportionately large number of negroes was afflicted. In New Orleans in 1850 only negroes contracted the disease; likewise in Memphis, 1862-1863, those that were huddled together there by the Confederates were the only ones affected. In like manner only negroes were stricken in Mississippi in 1862, in Maryland and in Mobile, Ala., in 1864, and in Philadelphia in 1867. However, A. Hirsch, who did not know of the conditions from personal observation, correctly surmises that not the race but the lodging, food, and general social conditions are responsible for the development of the disease. Whoever has observed the conditions in the south can verify this statement. I have recently visited one of the most civilized southern communities, Augusta, Ga. There are two negro quarters. In one of them an intelligent negress has for a dozen or more years been conducting a school for children of from 6 to 16 years. I saw hundreds of cleanly washed children both at work and at play, in clean, almost holiday attire. I was so struck that I inquired if it was a holiday. These four or five hundred children were all from the neighborhood. The houses, as well as the inhabitants, were clean, and there

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was a little garden in front of each house. Evidently the teacher and the children infected the entire suburb with their culture. There, in all likelihood, meningitis, if at all, will develop equally among the white and colored people. In another suburb I saw no gardens, no paint on the miserable reeking dwellings, and no clean linen on the line. Here we shall find meningitis in the future.

CEREBRO-SPINAL MENINGITIS—SYMPTOMATOLOGY AND TREATMENT

SYMPTOMATOLOGY

It is not worth the while this evening to go deeply into the symptomatology of the disease in general. I am not diligent enough to go through all the modern journal literature and from six books compile a new one nor to compile a new paper from manuals. You know from experience how one learns to disdain this kind of fame. But I will, in a few remarks, relate what during the last year and a half appeared surprising to me and was at variance with earlier observations.

The usual symptoms were headache, torticollis, vomiting in most cases one or more times, occasionally convulsions and coma, sometimes early but most often towards the end. Kernig's sign was present in all but two cases—in a patient of 25 years and one of 4 years.

Spots were not always present early, but at some time or another during the course of the disease; in a small number of cases strictly ischemic but becoming hyperemic after many minutes and remaining for several minutes longer.

In some cases the phenomena were unilateral at first and only gradually showed themselves on both sides of the body. A child of 3 years had a right total hemiplegia that was distinct for weeks, besides general symptoms.

The pupils were almost always alike: in the beginning of the diseases they were contracted as a rule, and later on, as coma increased, dilated; in every case they responded but slowly to light and in rare instances not at all.

What I have just said is in direct contradiction to my observations during the epidemic thirty years ago. There I almost without exception found the pupils strongly

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dilated from the very beginning of the disease, with no response or very little to the influence of light; and this symptom was considered as pathognomonic for the disease, and was ascribed by me to irritation of the cervical ganglion controlling the dilator pupillæ. It is worth the while to experience several epidemics of the same infectious disease.

I had a similar experience with the spots. In every earlier epidemic they appeared on the first day with such regularity that I believed also this symptom could be used for differentiation from other forms of meningitis. And this I taught up to a few years ago, but have since learned better. There are very many ways in which to err.

Among 58 cases there were petechiæ in 8, erythema with petechiæ in 1, papulous eruption in 1, general hyperemia with pustules in 1, uniform hyperemia in 1, and mottled hyperemia in 1 case, herpes in a small proportion of the cases, and not at a definite period of the disease; if it indicates an attack, it must be inferred that its appearance was belated for any length of time up to the end of the third week.

Apparently during the present epidemic the skin is not implicated as it was in former epidemics. Such differences are noted in the literature of various years and different localities. Vieusseux in his report on the Geneva epidemic in 1805 does not mention skin lesions at all, while North refers to their frequent occurrence in the epidemic of 1811. The name "spotted fever" dates from that time, and Upham speaks of the possibility of confounding the disease with typhus.

General hyperesthesia was very rare, which is decidedly at variance with the general behavior of former epidemics.

Opisthotonos in a high degree was rarely pronounced, torticollis always; moderate rotation of the head was possible in many cases, and in a few was even easy and painless.

Nasal catarrh was common last year (1904) but rare this year (1905).

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In a few instances taking a slow and fatal course irregular breathing of a Cheyne-Stokes' character set in early.

The deafness remaining after epidemic cerebro-spinal meningitis is probably not to be viewed in the sense in which it was described by Voltolini, who (*Mon. f. Ohr.*, 1867) looked upon it as an independent inflammation of the labyrinth. According to him it announced itself by intense headache, vomiting, high temperature and convulsions, which continued for several days and generally ended in recovery, but with deafness and trembling gait. It is probable that he had before him as a rule cases of cerebro-spinal meningitis of short duration. I observed deafness as an incurable sequel of the disease more frequently last year than this.

Blindness I have never seen in patients recovering. Osler (*Johns Hopkins Hospital Bull.*, 1892) reports a case of chronic cerebro-spinal meningitis the secondary blindness in which disappeared after a long period.

Other complications I have seen only very seldom this year. Among the many cases treated at the Roosevelt Hospital there was only one case of arthritis, one case of purulent pericarditis found at the autopsy. Pneumonia seems to have been very rare this year; consecutive neuritis I have not seen, most patients do not live long enough to get it. Renal irritation in the beginning does not seem to lead to nephritis.

The spleen is not so swollen as it is in the majority of other infectious diseases.

Councilman, as well as Jaeger (*Zeit. f. Hyg.*, xix., 1895), believed that animals in general are inaccessible to inoculation with the meningococcus; but Heubner produced the disease (*Jahrb. f. Kinderk.*, 1896; *Deut. Med. Woch.*, 1897) by introducing cultures into the spinal canal of goats. The entrance to the central nervous system thus appears to be easy enough anatomically. The extensiveness of the lymphatic network in the nose, the conjunctiva and the ear, the frequency of wounds of the surface in these organs, the thinness of the plate of the ethmoidal

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bone, make it appear really wonderful that Weichselbaum's diplococcus, which was found also in the conjunctiva by Schwabach in 1891, and in otitis by Scherer (the same diplococcus that was found by Heubner in 1896 in the subarachnoid fluid), does not more often reach the interior of the central nervous system.

In those cases where the disease is confined to the nerve centres, direct infection from person to person must be very difficult.

From an anatomical point of view all cases of meningitis are cerebro-spinal, that is, the brain and spinal cord are affected simultaneously. The arachnoid and pia should not be considered separately. The former constitutes the serous surface connected with the dura and one side of the subdural space. The pia represents a loose connective tissue containing lymph spaces and blood-vessels. As the choroid plexus this total membrane extends into the ventricles. In the spinal cord the serous arachnoid and the pia are separated somewhat and form a real subdural space, but are connected by numerous fibrous trabeculæ.

If in meningitis the spinal cord is affected more profoundly than the brain, and especially if the presence of the meningococcus intracellularis is considered of etiological importance, we are in the habit of referring to it as *cerebro-spinal* inflammation. In its epidemic appearance the membranes of the spinal cord are affected more decidedly than at other times, but the inflammation progresses along the course of the nerves and into the substance of the central organs. Changes in the tunica intima do not occur, however, in cerebro-spinal meningitis. In contradistinction to this, in tuberculous meningitis tuberculous deposits occur along the course of the vessels and in the fibrino-purulent exudate. True, the staphylococcus aureus, the streptococcus and the diplococcus lanceolatus produce epidemic cerebro-spinal meningitis, but they can be differentiated by their behavior in other tissues. Finally, the greater or lesser extent, depth and copiousness of the exudate, and the suddenness or slowness of the intoxication,

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afford the best explanation of the variability of the symptomatology.

TREATMENT

Preventive measures cannot positively prove to be effective, with the exception possibly as immunizing doses of an antitoxin. Inasmuch as in cerebro-spinal meningitis the invasion probably occurs only through the mucous membranes, the old rule holds which I have recommended since forty years in connection with diphtheria, namely: to keep the nose and throat healthy. I cannot understand why a modern author recommends the particularly mildly antiseptic boric acid as a general prophylactic.

There can scarcely be anything less consoling than a resumé of the various treatments that have been proposed. They seem to have had no influence, positively less than the character of the epidemics, the mortality having ranged from 30 per cent. to 90 per cent. In my own experience, which extends over several epidemics, the death-rate has been from 30 per cent. to 70 per cent. A summary of various methods of treatment is given in a paper read by Stockton two months ago before the State Medical Society and since published in the March number of the *Albany Medical Annals*. What I have advised during four dozen years can be found in my "Therapeutics." Let me briefly relate what I did myself and what I observed. The main thing in every case, whether severe or mild, is isolation, rest and moderate darkness. I deem it well to keep the head raised, rather by raising the head end of the bed than by the use of pillows only. It is essential to give sufficient food, as the disease may last for weeks and months and death not seldom sets in from inanition or under symptoms of starvation. Therefore every remission of temperature should be utilized for feeding. If vomiting be frequent, small, oft-repeated meals must be given. Such a meal is occasionally retained if 1 or 2 drops of Magendie's solution or a 2-mg. ($\frac{1}{32}$ grain) tablet of morphine have been put into the mouth a few minutes before, as far backward as possible. Once in a while feeding through the stomach tube becomes necessary, and

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I have it done three or four times daily. Rectal alimentation is seldom successful.

Rest at night, and even also by day as far as practicable, should be insisted upon. Bromides have proved of little avail, hyoscine useless; chloral by enema one or more times a day in doses of 0.03 to 0.05 gm. ($\frac{1}{2}$ to $\frac{3}{4}$ grain) has sometimes had the desired effect; the best results were obtained with the opiates—morphine and most often codeine—in not too small doses.

A very up-to-date city colleague claims to have obtained marvelous results with the continued administration of large doses of morphine. We will probably at an early date read an "interview" in some papers! The matter is of no further value.

The head should be covered with an ice-cap, and if possible a small bag should also be put at the back of the neck, but the latter application is difficult and at times impossible.

Occasionally I applied leeches to the nape of the neck and the mastoid processes. Cupping I did not do, nor have I resorted to bleeding since twenty years. A purgative should be given in the beginning of the treatment, preferably calomel. What is ordinarily a large dose may prove insufficient; it is not rare to meet with a child 3 or 4 years old who has taken as much as 0.5 gm. ($7\frac{1}{2}$ grains) of calomel in half a day, without the desired purgative effect or any other particular result. Vinegar and water enemas may assist the action. Saline purgatives are indicated, but it is rarely easy to give them. Baths are useful, but difficult to employ, because the patients are obdurate and suffer considerably during the manipulation. Hot baths I scarcely ever gave. Sponging with alcohol and water should be practiced for well-known reasons and has some effect. Should it not have sufficient influence upon high temperature, small doses of phenacetine may be administered, preferably combined with a small quantity of caffeine. Antipyrine I have used in this disease but little; during the many years that I have known this remedy it has seemed to me to fail to exert its usual action in brain trouble.

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Symptoms of weakness I have combated with camphor, musk or caffeine, seldom with alcohol.

I have been partial to the iodides, particularly sodium iodide, and in larger doses, that is, the smallest receive as much as 5 to 8 gms. ($1\frac{1}{4}$ to 2 drachms) daily. They are well borne as in all forms of meningitis, and they show themselves promptly in the urine. For about ten years I was as obstinate as the disease; but the disease I regret to say has exhausted my patience. Since four or five weeks I have completely abandoned the iodide treatment, and my results have not been any poorer than formerly. In olden times I employed sublimate hypodermically, but without visible benefit. Six weeks ago a 5-months old child was brought to me at the hospital with cerebral symptoms—striped look, slow reaction of the moderately dilated pupils, slight Kernig, sallow skin with mild yellow discoloration around the eyebrows and very slight torticollis. To me the diagnosis of syphilitic hydrocephalus appeared more probable than any other, and I even dispensed with lumbar puncture. The child took thrice daily 0.003 gm. ($\frac{1}{20}$ grain) of sublimate and 0.05 gm. ($\frac{1}{4}$ grain) of sodium iodide, and seemed to improve a little after a week or two. But after three weeks the torticollis increased and the meningococcus was present in the turbid spinal fluid. The case ended fatally.

During the period in which I employed the iodides as the routine treatment I did not perform lumbar puncture in every case; since that it has been the rule with me, partly as a diagnostic measure and in part as a remedy. A single puncture does not always suffice to establish the diagnosis; sometimes, when made early, the coccus is not found, but will be after one or several days. More frequently it happens, however, that the coccus appears two or three times and then, after a few days more disappears again, as the cases may vary also in other ways. Occasionally, but rarely, only a small quantity of a thick fluid exudes; and sometimes there is no flow at all. Here probably the foramen of Magendie is occluded. In many cases, however, the fluid is under pressure and the first 20 cc. or 30 cc. flow out in a stream; gradually the pressure diminishes. I have rarely

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drawn off or been able to get more than 30 cc. In these cases I have occasionally seen a lessening of the coma, but no effect upon the moderate dilation of the pupils. I am of the opinion that lumbar puncture is indicated in many cases, while I have never seen it have a harmful effect in any. I performed it in many cases three or four times or even oftener, for our cases as a rule gave us only too much time for its performance. A child of 4 years, in whom constant drainage was kept up, died.

Credé's ointment I used in two cases; collargol I employed per rectum in doses of 0.1 to 0.2 gm. ($1\frac{1}{2}$ to 3 grains) dissolved in 1 to 2 tablespoonfuls of boiled water, in two other cases for weeks, once or twice daily, but without demonstrable benefit.

In view of the hopelessness of the treatment, I made a trial during the last five or six weeks also of diphtheria antitoxin. Dr. Weitzfelder had favored me with information on the subject before he published his experiences or his views. I take it for granted that the method and its theory as propounded by Dr. Wolf of Hartford are known to you. Dr. Wolf discovered in his laboratory that there was an antagonism between the antitoxin and cultures of the meningococcus. The doses I employed subcutaneously or by intramuscular injection were those recommended to me by Dr. Weitzfelder, namely: 6000 units for children. I gave from three to six such doses in the course of as many or more days. My results were negative, as were also those obtained by my colleagues in other divisions of Roosevelt Hospital. Quite a number of cases were treated, without appreciable effect. I then proceeded in a manner outlined by Dr. Francis Huber, a colleague of Dr. Weitzfelder at the Gouverneur Hospital and Physician to the Beth Israel Hospital, who had an abundance of material at his disposal. I injected 1500 units of diphtheria antitoxin into the spinal canal, after withdrawing the usual quantity of fluid.

I made about 40 such injections, and the results confirmed the old story that not all laboratory observations can be utilized clinically. My best case, which will shortly be discharged as cured, did not receive any injection or

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any kind of treatment whatever. Several of the injected cases are doing very badly, some are in a fairly good state—just like the other cases, receiving different treatment or going without treatment. Unfortunately, in internal medicine many, very many, cases are necessary to try out any particular remedy or method of treatment and arrive at a positive conclusion. Nothing is more deceiving than premature reports in our journal literature, written with an enthusiastic desire to teach something new and useful, but really playing into the hands of whimsical doubt and even unjustified nihilism.

My hospital colleagues did just as I did. The Department of Health placed at our disposal countless thousands of units.

A few of our cases are briefly described in the following:

Man of 28, sudden attack, petechiæ, coma, high temperature. 12,000 units injected subcutaneously on second day, 10,000 more 12 hours later and 8400 on third day, making 30,400 units in all. Died on fourth day. Several lumbar punctures had been made.

Man of 18, case similar to preceding. 12,000 units hypodermically on second and third days. Died on third day.

Child of 8 years, severe case. 6000 units subcutaneously on second, sixth and seventh days, 1500 intraspinally on eleventh and eighteenth days. Not quite dead as yet.

Child 3½ years old, mild case. Vomiting, delirium, torticollis. 6000 units on third, fifth, seventh and tenth days, subcutaneously, 1500 intraspinally on twelfth day. On twenty-eighth day temperature still intermittent but gradually falling, spinal fluid clear.

Man of 41, severe attack, only occasionally conscious. 2000 units intraspinally on fifth and seventh days. Died on eighth day.

Child of 6 years, severe attack, unconsciousness, convulsions. 1500 units intraspinally on third day. On eighth day still high temperature, but conscious.

Child of 8 years, severe case, with chills, headache, delirium, opisthotonos. 1500 units intraspinally on fourth

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day, on seventh 1500, on tenth 2000, on eighteenth 1500 and on twenty-third 600 units subcutaneously. On twenty-fourth day brain and spinal fluid clear. Temperature intermittent. Deaf.

Child of 7 years, sudden attack, chills, headache, vomiting, torticollis. On third and fifth days 1500 units intraspinally. On fifteenth day temperature between 98° and 101° F., consciousness returned, neck less stiff, some appetite.

Child of 6 years, mild attack, convulsions. On fourth and three following days 6000 units each time subcutaneously. On forty-eighth day temperature still 101° to 102° F., patient irritable and emaciated. Will probably die.

Child 4½ years old, severe attack. On twelfth and following five days 6000 units each time. Very emaciated, hydrocephalus. Will doubtless die.

Child of 12 years. On sixth day 1500 units intraspinally, on seventh day 12,000 subcutaneously. On fifteenth day patient conscious. Will recover.

Child of 10 years, mild attack. On fifth day 1500 units intraspinally, on seventh day same. On fourteenth day patient pretty well, with acute inflammation of right knee.

Of th 21 cases 9 have already died.

During the year 1904 we had 25 cases in adults, 15 = 57.6 per cent. proving fatal; 23 in children, 10 = 43.5 per cent. ending in death. From January 1 to April 1, 1905, we admitted 36 cases. Of these 20 are no longer in the hospital, 11 children and 5 adults being still here. Two of the 11 children received no antitoxin, 6 received intraspinal injections of it (on the average 1500 units, one or more times), in 3 it was injected subcutaneously. One case has recovered, another is nearly well but deaf, a third nearly well but with acute inflammation of one knee; 1 case quickly recovered without any treatment, 1 seems to be improving but is doubtful, 1 has improved but still has intermittent pyrexia, 1 has had a relapse, 2 are exceedingly emaciated, 1 has high temperatures which intermit, however, 1 has a low temperature with all the signs of chronic inflammation. Of the 5 adults remaining alive, 1 is perfectly well, 1 very doubtful, 2 on the way

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to recovery, 1 is much better but occasionally irrational and may recover.

Of 5 children leaving the hospital during these three months, 1 was discharged January 14th with deafness, no antitoxin had been administered; 1 discharged cured January 20th, no antitoxin; 1 died March 1st, no antitoxin; 1 died March 29th, had antitoxin; 1 died April 2d, had antitoxin.

Only 1 of the 15 adults in the hospital since January 1st has been cured, without antitoxin; 4 died without antitoxin; 10 died in spite of antitoxin treatment. In all probability our cases this year (1905) will show a mortality of 60 per cent.

Since January 1st, 1904, 85 cases have been admitted; 16 are still at the hospital, 69 have passed from observation. Of these 25 died during 1904, 3 were taken away uncured and their termination is unknown, 17 (out of 20) can be proved dead—thus 42 deaths out of 66 cases, equivalent to 64 per cent., up to date. Of those who have remained living 3 are deaf and 1 is blind.

Once death set in within 30 hours, in a child 12 years old; once within 38 hours from the onset of the disease, in a child of $3\frac{1}{2}$ years. In the latter case the pupils were unequal, and there were convulsions, coma and a temperature of 103° to 109° F. Death survened in another case after 2 days, while in still another after 55 days. Still longer periods of sickness have not yet terminated in death, the patients are still struggling. A child 3 years old was dismissed after 55 days with deafness; one of 10 years was discharged cured after 90 days; two of 5 years were discharged perfectly cured on the 69th and 76th day, respectively, one of 8 years on the 100th day. Thus, of 100 patients two-thirds died and several were crippled. Whether the affected nervous centre of those who have recovered will ever be perfectly normal is uncertain. Those of us who have become familiar from personal observation with the obstinacy of the disease process, will probably not be able to dispel their doubts as to the completeness of the recovery. For me there is nothing more sad and more disheartening than

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a hall filled with cases of epidemic cerebro-spinal meningitis.

POSTSCRIPTUM, MAY, 1909.

Nulla dies sine linea. That is almost literally true in regard to medicine, whose practical benefits are appreciated by everybody except the hypocrites or fanatics of the "antivivisection" creed. The hopelessness of the victims of the meningococcus is no longer absolute or even nearly absolute. Simon Flexner's name has suddenly, and deservedly, become a household word in both hemispheres. I listened to him recently when he lectured at Baltimore before the Medical and Chirurgical Faculty of Maryland, (May 14th 1909). He was as modest and withal hopeful as always. He is rather doubtful and cautious when others are joyful and enthusiastic; but he cannot disclaim the beneficial results of his antimenigitis serum. Even to-day cerebro-spinal meningitis is amenable to treatment, thanks to Flexner, and many who formerly would have died of the infection, are now saved.

When Flexner was in a position to supply patients with his serum, the New York epidemic was relenting. That is why he does not consider our local experience as momentous or conclusive, but prefers to reckon with the bad cases of a beginning epidemic only. The epidemics of the middle West have been grave, but were decidedly influenced by the use of the serum. Of seven cases in the Jefferson, Mo., barracks only two died; of five in which the diagnosis was made early, all recovered with the serum. In McKinney, Texas, after four cases had died in a single family, five other cases, who could be supplied with the Flexner serum, recovered. The speaker mentioned three recoveries in five cases occurring in the practice of Dr. Koplik. The most conclusive results have been obtained in the recent epidemics of Europe, where the diagnoses were made earlier and the serum treatment resorted to in due time. England, Scotland and Ireland have active epidemics, and the disease is decidedly modified by the serum. The former mortality of 75 per cent. has been reduced to 40 per cent. in Edinburgh, to from 25 to 30 per cent. in

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Belfast. The character of the cases has changed; the protracted chronic course which extended over several months, ceased abruptly in the hospital wards. France had a severe epidemic of two or three months. Netter had fifty cases. Of ten children under two years of age that were treated with Flexner's serum, he lost one. Calmette treated fourteen soldiers in the barracks of Lille. One died. Three were sick outside the barracks with no serum. They all died. Roux expresses himself as being greatly struck with the results of serum treatment. And as we go to press we glean from the *Lancet* (May 15, 1909) that the epidemic in France, which is now on the decline, has made two things perfectly plain: the one is that the disease is extremely contagious and the other that the use of anti-meningococcic serum is of great value. The epidemic in the garrison at Evreux, which M. Vaillaire studied with particular care, showed that the contagion spread from one soldier to another when they occupied contiguous beds in the same room. Some reservists who had been in barracks at Evreux and who had been sent home when the epidemic broke out carried the infection with them even if they showed no signs of the disease themselves. One of them, who was quite well, infected his wife who died; another infected four other persons, of whom two died. Examination of the troops in barracks showed that in 19 per cent. of them the meningococcus was present in the naso-pharyngeal mucous membrane. Of 24 cases treated otherwise than by serotherapy 16 died, and of the same number of cases treated with the serum only four died, the mortality in the one case being 66.6 per cent. and in the other 16.6 per cent. The earlier that the serum is administered the better are the results and therefore an early diagnosis is of much importance.

The world does move.

DIPHTHERIA: ITS SYMPTOMATOLOGY AND TREATMENT

INTRODUCTION

Definition.—Diphtheria is a specific, infectious and contagious disease characterized principally by epithelial changes and by the exudation of fibrin on or in mucous membranes, or on the surface of wounds, or in the denuded rete Malpighi, constituting the so-called pseudomembranes. These are mostly found on the accessible mucous membranes of the digestive and respiratory organs. Their morphological structure in the throat, nares, larynx, and other places is identical, but they have been studied chiefly in the throat, where they are most frequently found. They consist of finely reticulated fibrin holding exudate cells, leucocytes, some few erythrocytes, and characteristic microbes. When they are superficial, it is the epithelial protoplasm which is thus transformed; when they are deep-seated with a tendency to necrosis, ulceration, and finally (if recovery take place) cicatrization, it is the fibrillar basic substance of the connective tissue, chiefly of the mucous membrane, sometimes also of the submucous and deeper structures. This view, which underlies the discussions of all my contributions to the subject of diphtheria since 1860, has lately been again most forcibly demonstrated by Baumgarten (*Berliner klinische Wochenschrift*, Nos. 31 and 32, 1897).

History.—Diphtheria has been epidemic on the Atlantic coast of North America since 1857. The disease was almost unknown at that time—my paper on diphtheria and diphtheritic affections in the *American Medical Times* of August 11th and 18th, 1860, was the first (or among the first?) of those which were written on the subject in our part of the country during the last half century—but

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the literature has since grown immensely. It was very extensive when I collected it in my essay on "Diphtheria" in the second volume of Gerhardt's "Handbuch der Kinderkrankheiten" (1877). It soon took such dimensions that neither in my "Treatise on Diphtheria" (New York, 1880) nor in Pepper's "American System of Medicine" (Vol. I., 1885), nor in other publications did I do more than refer to authorities for the elucidation of particular points. For many years past it has been the etiology of the disease which has created a literature of its own; so has that part of the subject which treats of antitoxin and of intubation. Symptomatology in all its bearings and morphology have not received many valuable additions; for clinical observations, when correct and correctly reported, are not "subject to change and at the mercy of unknown factors," as a great experimenter has lately said. On the contrary, the vast amount of labor, as exhibited in endless journal articles and books on special topics, which has to be spent on the establishment, verification, or refutation of a single fact in bacteriology, does not prove that "the results obtained by experimentation in the laboratory are unambiguous" to the exclusion of clinical empiricism. Thus it happens that on the following pages I shall frequently repeat statements (many now out of print) which have been found correct in the course of time, and give advice that will still be found serviceable though it was offered decades ago.

Virchow distinguished between croupous and diphtheritic membranes. In his opinion the former was fibrinous with cell proliferations, epithelia, and pus, and was superficial on top of the mucous membrane; the latter was an exudation into the tissue of an amorphous, dense, and coagulated fibrin which did not always injure or implicate the surface epithelium, but would necrose the deeper tissue and give rise to ulceration before healing. But he admitted that complications between the two were very common indeed. Weigert and Cohnheim were of the same opinion as far as the morphological condition and localization of the membranes were concerned; the essential process according to them was a combination of necrosis and in-

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flammation, and their causes, after Recklinghausen and Nassiloff had assumed the primary change to be a microbic invasion, were bacteria and toxins.

According to Wagner the only difference between croup and diphtheria membranes was the fine structure of and the admixture of pus cells to the former. Both of them had their origin in the epithelium, while Buhl looked for it in the mucous membrane itself, in the cells of which nuclear or cystoid proliferations took place.

I cannot detect much difference in the theories which have since been brought forward, for instance, in those of Oertel or of Heubner. The question is always one of degeneration of epithelia, of the presence of leucocytes, an exudation of fibrin, more or less admixture of blood, of hyaline masses, and of new formation of more or fewer round cells in different localities. Oertel comes to the conclusion that, after all, the localization of the process is the final cause of the form and appearance of the pseudomembrane. Why he should make the effort of suggesting the differentiation between a primary and a secondary membrane, the former consisting of direct surface deposits, and the latter of membranous deposits in the tissue which are produced by the presence of other surface deposits in the neighborhood, is not quite intelligible except on the score of "completeness."

For some years it has become customary to distinguish between those pseudomembranes which are caused, or accompanied, by the Klebs-Löffler bacillus, and those which contain the "pseudobacillus" or staphylococci and principally streptococci. That these microbes do not establish any disease by their mere presence, that on the contrary they are met with to an indefinite degree in the mouths and throats of the healthy, is well understood. That they may be considered pathological, or pathogenic, the presence of pseudomembranes and the presence of the microbes in the pseudomembranes in some stage of development is required. The Klebs-Löffler bacillus is, however, not always found in every stage of the illness; it appears to perish quite often towards the maceration period. When found it is located in the superficial layers of the pseudo-

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membrane only, and not throughout its whole thickness; the coccus, however, pervades its whole substance, usually in greater numbers in the deeper layers. To explain the absence of Klebs-Löffler bacilli from these, it is assumed that they are destroyed by other microbes. Still they are credited—in the same way in which they can be proven to do so in the laboratory—with evolving the toxin which gives rise to all the symptoms and dangers of certain forms of constitutional diphtheria.

Pseudomembranes containing Klebs-Löffler bacilli are called by almost universal agreement *diphtheritic*, those with pseudobacilli and cocci *pseudodiphtheritic*. Local diphtheria ("diphtheritis"), constitutional diphtheritic infection, and diphtheritic sepsis are different degrees of the same disease. The first may run a fairly mild course, or be the initial stage of the second and (or) third. Those cases which present both bacilli and streptococci in their membrane are called cases of *mixed infection*. It has been claimed that cases of the second class, that of streptococcus infection, are of little virulence and attended with but little danger. This opinion leads to cruel mistakes in management, both by boards of health and by such medical men as are influenced by them. For not only are many uncomplicated cases very grave, but the mixed infections are the very worst forms met with in practice. Moreover, the streptococcus cases are contagious, contrary opinions notwithstanding. Still, it is important to mention at once that accurate differentiation has its great practical value, for the reason that it is solely the bacillary variety that can be influenced by the diphtheria antitoxin (see below).

The part played by microbes in diphtheria is not yet absolutely clear. The Klebs-Löffler diphtheria bacillus and a similar bacillus that is not virulent are found in diabetic and in common tuberculous lungs, in noma, in empyema, on chancres, in ozæna, and in vaccinia pustules. It is claimed that there are differences between the two; the pseudodiphtheria bacillus is described as plumper, shorter, and more uniform than the genuine Klebs-Löffler, but this difference is not so striking as not to be denied

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by many; nor is there unanimity among different examiners in regard to other differences. Many go so far as to deny the possibility of a differentiation. Loeffler himself has finally come to the conclusion, lately expressed in the Congress of Hygiene at Madrid, that the genuine diphtheria bacillus cannot be diagnosticated in any other way than by its power to generate the diphtheria toxin and by the influence the diphtheria antitoxin has on the bacillus, or rather on the disease. Thus it is acknowledged that there are saprophytes which can be distinguished from genuine diphtheria bacilli by nothing but the absence of virulence.

Another authority, C. Fraenkel, admits that the degree of virulence is so variable that it cannot be employed for differentiation. A very virulent bacillus loses its virulence by a change of the culture medium, and feebly virulent bacilli are rendered highly so by adding streptococci (Roux and Yersin). Moreover Trumpp mixed "pseudobacilli" found in the pus of empyema with diphtheria toxin (not bacilli), made new cultures, and obtained very virulent bacilli; and he found that repeated injections of pseudobacilli would finally kill like genuine bacilli.

F. Schanz (*Deutsche medicinische Wochenschrift*, No. 37, 1898), who lately elaborated these considerations and facts, adds the pertinent remark that a bacillus which is so frequently found on the mucous membranes of the healthy or of the convalescent without the presence of diphtheria, appears to play only an inferior and secondary part in the development of disease. He thinks that the bacillus increases on inflamed surfaces and attains the power of producing a toxin in the membranous exudation only; that it is this toxin which adds to the danger of the disease, and that the presence of streptococci increases its peril; and that it is not impossible at all to assume that diphtheria originates from an unknown cause of its own, but becomes more virulent by the action of the toxin of the Klebs-Löffler bacillus (with or without the aid of streptococci), whose effect may be destroyed by the diphtheria antitoxin.

Evidently the question of the origin (single or multiple)

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of diphtheria does not seem to be settled to the satisfaction of all. According to Theobald Smith (*Boston Medical and Surgical Journal*, August 25th, 1898) "it is only clinicians whose voices are sometimes raised against the Klebs-Löffler bacillus as the chief cause of diphtheria"; but Löffler himself, and C. Fraenkel, and others, equally conscientious, are more careful than formerly in expressing positive views and are less averse to retracing their steps.

There are other questions in connection with diphtheria which seem to be positively settled, for instance, that of the morphology of the pseudomembranes. In Gerhard's "Handbuch" and in my "Treatise" I studied the subject with a view to elucidate the differences in the condition of morphologically identical pseudomembranes when found in different locations.¹

Morphology of Pseudomembranes.—Twenty-five years ago Trendelenburg infected the trachea of a rabbit with diphtheritic deposits which he had removed from the pharynx and tonsils, in the tissues of which they were deeply and firmly imbedded. The new deposits, however, did not take so deep and firm a hold on the tissues as the original ones, but adhered lightly to the mucous membrane of the trachea to which they had been transplanted. This and many other similar facts cannot be explained by the nature of the pseudomembrane, but by the histological character of the mucous membrane only, which varies with the locality. Its different elements, viz., the epithelium, basement membrane, connective tissue interwoven with elastic fibres, with blood vessels, with nerves from the cerebrospinal and sympathetic systems, and frequently with spindle cells, and the papillæ ducts of numberless glands, all influence the pathological process going on upon the surface.

The mucous membrane of the *mouth* contains a large

¹ These bacteriological statements and the following referring to the morphology of pseudomembranes are considered by the author necessary for the explanation of much that he has to say on symptomatology and treatment.

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number of elastic fibres mixed with cellular tissue and covered by a thick coat of pavement epithelium; its uppermost layer contains flat cells, the second a larger quantity of polygonal cells, and the lowest oval ones which assume a perpendicular relation to the mucous membrane. From the mucous membrane a number of papillæ extend into the epithelium, and in this respect they resemble the papillæ of the skin. Acinous muciparous glands are frequent, and most numerous in the anterior aspect of the soft palate. Lymph vessels are very numerous in the lips, tongue, uvula, soft palate, anterior and posterior pillars of the soft palate, and cheeks. The *uvula* contains so many that, if they be injected its circumference is increased two or three fold. They empty into the deep facial lymph bodies to which they communicate diphtheria as well as other infections. The lymphatics of the *tongue* are in intimate connection with the upper layer of the deep cervical, those of the *floor of the mouth* and many from the tongue connect with the submaxillary lymph bodies. The efferent vessels empty their contents into the superior jugular lymph nodes, situated in the trigonum cervicale superius, and finally into the fifteen or twenty inferior jugular (or supraclavicular) nodes which with numerous anastomoses form the jugular lymphatic plexus. The *tonsils* are conglomerations of an indefinite number of follicular bodies, each of which has a thick capsule which is of irregular shape, and consists of connective tissue lined by mucous membrane and pavement epithelium. The connective tissue contains a number of closed follicles, each inclosing numerous lymph corpuscles. The follicles have been considered identical with, or analogous to, the lymph bodies; this assumption is purely problematical, since it has not been possible thus far to verify the existence of afferent or efferent ducts. The practical deduction from this is that the tonsils have little connection with the lymphatic system, and that a disease limited to a tonsil is not liable to infect the organism immediately and intensely.

The mucous membrane of the *nasal cavities* is of varying degrees of thickness; it consists of connective-tissue

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fibres with numerous nuclei, is free from elastic fibres, but is supplied with a large number of nerves and an abundance of blood-vessels; the Schneiderian membrane possesses in fact a larger number of blood-vessels than do most of the other mucous membranes. That is why, with its submucous tissue, it frequently is the seat of swellings and hemorrhages, as well in diseases of distant organs which give rise to venous stagnation, as from the slightest local provocation. The inner surface of the cartilaginous portion is lined with pavement epithelium; the lower region of the real nasal cavities, the so-called respiratory portion, through its whole length supplied with branches of the trifacial nerve, is lined with cylindrical epithelium and contains a large number of mucous glands. The upper or so-called olfactory portion is lined with ciliated epithelium, and is supplied, according to Todd and Bowman, with long, straight, tubular glands. Here the lymphatics are but poorly developed, while in the inferior portion they are very numerous; all their openings communicate directly with the deep facial and posterior sub-maxillary lymph bodies. Thus it can be readily understood why the slightest irritation, by a nasal catarrh for instance, in a child produces a temporary or permanent swelling of the lymph nodes and why the nares should necessarily, by their multitude of toxin absorbing lymph follicles and ducts, be among the most dangerous localizations of diphtheria.

The *epiglottis* carries a layer of pavement epithelium of 0.2 mm. in thickness on its anterior superior surface, that on its posterior surface being from 0.06 to 0.1 mm. in thickness. The superficial layer consists of spheroidal or polygonal cells, the deeper is of cylindrical cells arranged perpendicularly to the surface. Near the insertion of the epiglottis, the polygonal cells disappear, the cylindrical occupy the surface, and are furnished with cilia 0.005 mm. in thickness. Beneath these there are round and oval cells in considerable number, so that the whole epithelial coating has a thickness of 0.5 mm. Ciliated epithelium is also found on the *false vocal cords* and in the ventricles of the *larynx*. Polygonal pavement epithelium forms the

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covering of the posterior surface of the pharynx, of the aryepiglottic folds, where the mucous membrane possesses, in addition, a heavy and lax submucous tissue, and of the true vocal cords. As one approaches the laryngeal ventricles and trachea, the previous coating is replaced by delicate ciliated epithelium. The mucous membrane in the neighborhood of the laryngeal ventricles is itself very loosely attached, exceedingly thin, and frequently thrown into folds on the vocal cords. Acinous glands are here abundant, being fifteen to twenty to the square centimetre, and arranged lengthwise. Around the ventricles they are very numerous, and their outlets are lined with cylindrical, rarely with ciliated epithelium. The true *vocal cords* are not supplied with glands of any kind.

The acinous glands have no lymphatics leading into them, but the latter may be seen in other parts of the mucous membrane of the larynx and in the submucous tissue. In fact, they are both large and numerous, and have the general character of lymphatics, as regards the endothelium in particular. In the epiglottis of the newborn they form but a single layer, in the larynx and trachea two layers, and in certain parts which are covered by a considerable amount of submucous tissue, there are even three layers. Innermost the lymphatics are arranged perpendicularly to the surface; outermost, horizontally.

The comparative absence or scantiness of lymphatics over the larger part of the surface accounts for the absence of constitutional symptoms in localized laryngeal diphtheria ("pseudomembranous croup"), and the extensive layer of pavement epithelium accounts for the persistence of membranes both on the epiglottis and in some parts of the larynx.

The mucous membrane of the *trachea* and *bronchi* contains more elastic than fibrous tissue, a moderate amount of lymph vessels, no lymph bodies, but an abundance of mucous glands, and is freely supplied with ciliated epithelium.

Among all the tissues and organs thus far spoken of, the elastic tissue, which is an important element in the formation of connective tissue, is least affected by chemical

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or organic influences. It is not present in the mucous membrane of the nose, but to a considerable amount in the buccal cavity, is very abundant in the walls of the lymph follicles of the tonsils, and predominates in the trachea. The influence of these anatomical conditions on the diphtheritic process must be very marked. It can easily be demonstrated that where the elastic tissue is prevailing, a resistance to diphtheritic impregnation is maintained for a long time, but when it has been forced to yield, there is a corresponding resistance to recovery.

It is the pavement epithelium that gives the easiest foothold to diphtheritic membrane. Where it is most abundant, the diphtheritic process can best settle and develop. That is why the tonsils, not from their prominent situation alone, but from the character of their surface also, are favorable to the reception and further development of an infection, and their elastic and connective fibres, when at last affected, are apt to harbor the process a long time. Ciliated epithelium, on the other hand, is not liable to be invaded. It occupies a higher rank in the scale of animal formation, and has a more complex function and a greater power of resistance; besides, it expels by its constant movements microscopic foreign bodies.

The presence of a large number of mucous glands impedes, as a rule, by the presence of the normal secretion, an extensive destructive action upon the tissues. The secreted mucus assists in removing epithelial masses, and even fibrinous exudations, from the surface. The underlying tissues themselves do not always take an active or prominent part in the process; the serum of the mucus penetrates the parts which are the seat of morbid deposits, and tends to predispose the latter toward maceration, and the mucous secretion raises mechanically the superjacent deposits from their bed. Thus it is that the deposits in the respiratory portion of the nasal cavities are frequently cast off through the nostrils, probably because they have been produced in excess; and in a similar manner, the membranes that have formed in the trachea are ejected in a semisolid condition through a newly made tracheotomic, or even the natural, outlet. The large number of mucous

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glands in a part of the larynx and in the whole trachea is unquestionably the reason why the lymphatic vessels of the mucous membrane, even where they are present in large numbers, are not influenced by the overlying loosened masses, and will not absorb; hence laryngeal and tracheal forms of diphtheria have a decidedly local character, and are mostly devoid of constitutional symptoms.

The *vocal cords* form the borders of the narrowest aperture of the air passages; they detain or retain foreign bodies, whether malignant or otherwise; they are covered with pavement epithelium which, as has been remarked, is the principal resting and breeding place of the diphtheritic affection. They have no defence furnished by muciparous follicles, and therefore if there is any part which is predisposed to a local diphtheritic infection it is certainly the vocal cords. That is why in the beginning of an epidemic of diphtheria, or when it is dying out, a local diphtheritic infection can still take place, and individual cases occur now and then with an almost insignificant power of infection. Such occurrences took place previous to the ubiquity of diphtheria forty years ago, and are still met with under the same conditions, giving rise to the so-called sporadic membranous croup.

On the other hand, the absence of acinous glands on the vocal cords must serve to a certain degree as a guard against the disease. Dry, atrophic, but at the same time uninjured and smooth conditions of the mucous membrane of the fauces tend to ward off an attack of diphtheria. A more or less moist or viscid condition of the surface is necessary in order that the infecting material may cling thereto. The comparative dryness of the vocal cords, however, considered by the side of the perpetually moist and uneven surface of the pharynx, would not appear so favorable to the deposition of foreign infectious elements. Thus there are certain conditions predisposing to, others antagonizing infection. They demonstrate, however, why laryngeal croup is more frequent in winter than in summer, in direct proportion to the greater frequency of laryngeal catarrh in winter than in summer. Diphtheritic membranes on the vocal cords are not easily cast off, for there

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are no subjacent muciparous glands whose secretion could wash them away. No general infection can arise from them, for they have no lymphatic vessels which could serve as carriers of the poison; furthermore, suffocation from a local cause occurs too early to enable the few neighboring lymphatics to absorb and transport the toxin elsewhere, in case the deposits should finally become macerated.

The comparative absence of the lymphatics and the paucity of blood-vessels explain why diphtheria of the tonsils has so mild a character. The large number and size of, as well as the direct communication of the lymphatic ducts of the Schneiderian mucous membrane with the lymphatic glands of the neck account for the dangerous character of diphtheria of the nose. However, direct infection, *i.e.*, the absorption of the poison into the body, is not always dependent on the lymphatics, for they have occasionally neither enough time nor the opportunity to use their power. For instance, in those cases of diphtheria of the nose in which early and slight epistaxis occurred, the poison appears to have been absorbed directly into the blood-vessels. Then we fail to observe the ordinary swelling of the neighboring glands of the neck, but the general symptoms are very rapidly developed. Usually, however, infection results through the lymphatics. The fluid contents of the tissues, or such particles or elements as are suspended therein, be they of a gaseous, chemical, or parasitic nature, are conducted to the lymph nodes and into the circulation. There may be, however, two impediments in the current. In the first place, the foreign material may be present in too large an amount to circulate with ease; the result will be stagnation and consequent irritation, either in the fascia propria or in the substance of the lymph nodes. By pressure, the capillary circulation becomes interfered with, proliferation ensues, the circulating lymph mingles with the white corpuscles from the lymph spaces, and the result is an abscess in the intra- or periglandular tissue. Or the foreign material is retained in the interior of the fascias, in the connective tissue, or in the dilated lymph vessels of the cortical sub-

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stance. Thus fluids injected into the cortical substance have been found collected in the external portions of the lymph nodes, where it was impossible for them to be carried into the circulation. Hence the lymph nodes may serve as the receptacle of noxious elements which have circulated in the lymph current, with or without danger to the integrity of its tissues. In this manner a second attack of diphtheria may often find its explanation in the absorption of stowed-away poison; as we see in the case of syphilitic or other infections, which may either be stored in the lymph body unchanged and inactive, or if their presence prove irritating, give rise to speedy suppuration, and even elimination, provided the abscess be opened sufficiently and early.

Dissemination of Diphtheria.—Diphtheria is a contagious disease. It is usually transmitted from the sick to the well by the moist or dry discharges from the nose and throat of the sick person. This transmission may take place directly or indirectly in so many ways that it is not always possible to trace an individual case to its source. It is the multiplicity of mostly unknown modes of transmission which confuses and bewilders. The vulnerability of the young mucous membrane, the frequency of nasal and pharyngeal catarrh, the narrowness of the nose, the large size and softness of the tonsils, the frequent fermentation of food in the mouth, the sucking of the soiled little fingers, together with the influence of family disposition, which is more powerful in the young, the constant intercourse of children with each other in large families and in densely populated houses and districts, in schools and on playgrounds, the possibly long period of incubation during which the disease is contagious though giving rise to no symptoms, act as just so many predisposing causes of contagion; and the large number and size of the lymphatics in the young render every attack so much the more dangerous.

The very facts that diphtheria need not always be of the same type; that many cases of lacunar or follicular amygdalitis ("tonsillitis") are diphtheritic—that there are as many cases out of bed and out of doors as in bed and indoors; that, particularly in adults, diphtheria may last

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long and give rise to but few embarrassing symptoms, and that a mild case of diphtheria may, by contagion, produce very serious ones, render contagion by nursery maids and other domestics, by teachers, seamstresses, sick-nurses, workmen, factory girls, shopkeepers, barbers, and all other persons mingling with the many extremely easy. The vitality of the diphtheria germs is persistent, as is well known, and may extend over years. They cling to solid and semisolid bodies, are imported in milk, cling to walls and floors, to toys, to curtains, towels, clothing, and bedding which is so often kindly donated to the poor by the benevolent well-to-do when they wish to get rid of their own dangers. They stick to omnibus and carriage cushions, to car seats, to the either ready or custom made coat on one's shoulders near which one's baby will nestle—the very coat that is sold in Broadway palaces after it has been made in the pest-stricken tenement sweating shop. The very restlessness of our people, the frequency of moving into unknown and often infected quarters, is another cause of doubling the number of cases. There can be no doubt, besides, that many animals—horses, chickens, cows—have and spread diphtheria. Thus it appears that we ought to think twice, and indeed many times, before admitting among the causes of diphtheria new factors which cannot be proved.

“No contagion could be traced.” That is the introduction to every wild and unproven theory of indigenous spontaneous generation. When a case of cholera breaks out in a village a thousand miles away from the coast, is there anybody in our time who looks after chemical poison in a well or filth on the roofs? We look for direct or indirect contagion from a tangible source. Why not so in diphtheria? In the *New York Medical Journal* of September 27th, 1886, I quoted from Isambert the case of a medical assistant who had nasal diphtheria many months, and then travelled half a year to get rid of the last remnants. He fully recovered; but how many deaths did he cause—going from railroad car to railroad car, from stagecoach to stagecoach, from hotel to hotel? How many may have been the physicians who searched in vain for

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the cause of the sporadic cases suddenly springing up in their towns, and the epidemics generated by them along the roads on which the luckless wanderer after his own health had strewn out his curses? Nobody suspected the traveller who left days ago, just as nobody may be able to trace every outbreak of cholera to the unknown person who carried it upon his person or in his bowels. Nor is this an isolated case of a long duration of diphtheria. Cadet de Gassicourt operated for laryngeal diphtheria after eighteen, twenty-three, and forty-three days. Sanné had croup patients who recovered after twenty-seven, thirty-two, and sixty days. I know of many cases of diphtheria protracted into the second or even the third month.

Golay reported the case of a boy of five years who had the diphtheria bacillus three hundred and sixty-two days.

During this time he had three acute attacks of diphtheria and four injections of antitoxin. Golay draws the conclusions from his report (*Revue médicale de la Suisse Romande*, 1897) that a fortnight's isolation after the disappearance of the false membrane, as advised, is inadequate; he does not believe in recovery until three or four examinations for bacilli made in intervals of a week each have proved unsuccessful. He also finds that the presence of the bacillus in the throat does not interfere *per se* with the general health; also that the bacillus is apt to remain a very long time unless there is a complicating streptococcus infection. In this case he tried many local applications (Lœffler's included) in vain.

Such facts, pointing as they do to the ready communicability of diphtheria, have influenced my opinion from early times. I cannot see anything miraculous in the sudden appearance of a *bacillus diphtheriæ* or a *streptococcus* in a person *apparently* not exposed to it. During an epidemic there is *nobody not exposed* to it, and everybody is subject to it under favorable circumstances. The latter mean a fit condition of the human integument, either cutis or mucous membrane, which makes it liable to become a resting-place for the germ. That fit condition is a slight or severe wound, abrasion, denudation of the surface. As

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no healthy surface becomes erysipelatous in spite of erysipelas being epidemic ("erysipela non est sine vulnere," Galen), as Fehleisen's bacillus requires a sore, so diphtheria, being ubiquitous and waiting for a chance, will stick to a cutaneous wound, a stomatitis, a pharyngeal or nasal catarrh, and will rapidly multiply. A resected tonsil will thus be covered with a pseudomembrane within a day.

I have been quoted as favoring the sewer-gas origin of diphtheria, though (with the exception of a careless expression on page 50 of my "Treatise on Diphtheria") I always, since 1860, strenuously expressed my conviction of the communicability of diphtheria solely by contagion (direct or indirect). Jenner in 1861, Wilks in 1873, Thorne Thorne in 1893, expressed the same opinion. I believe it is the latter careful and most painstaking observer whose statements, together with the discussion on the subject contained in the *British Medical Journal* of 1893 and 1894, in which Wilks, Davis, Priestley, C. M. Jessop, and J. Bunting—in opposition to George Johnson, Parker, C. N. Allfrey, N. G. Warrey, and P. G. Marriott—favored the exclusive contagion theory, have done most to establish the latter forever in the minds of our British brethren.

The vitality of bacilli is remarkable. It is true that direct light kills them after a while; even diffuse light has a similar though slower effect. It is also true that they do not live outside the body so long as on the human mucous membrane, and that one observer (Spengler) did not find them after one hundred and twenty days, and others (Wright and Emerson) found few only on brushes, and none on clothing or on the finger nails. But Abel found them on children's building blocks after five months. They resist desiccation a long time, in membranes (Roux and Yersin, Park, Loeffler, Germano), in tissues (Loeffler, d'Epine et de Marignac), and in dust (Reyes, Germano). Rapid desiccation, even by means of sulphuric acid, does not injure their virulence, which is preserved the better (being protected against oxidation) the thicker the surrounding dust. The latter may be the vehicle of conta-

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gion. Moreover, weeks and months after an attack of diphtheria, bacilli have been and are constantly met with in the throat, nose, antrum, and middle ear. We should not forget that no number of negative observations can outweigh a single positive result. And we do know, those of us who have not forgotten the value of clinical observation, that the infection of diphtheria in bedding and in rooms, which harbored diphtheria a year previously, has started it again in newcomers after they had dwelt there long enough for incubation.

There is no origin for diphtheria except in contagion. Sewerage has nothing to do with it. In a paper published in the Transactions of the Third Congress of American Physicians and Surgeons (1894) I presented the following conclusions:

The atmosphere contains more or less specific disease germs, both living and dead.

They are frequently found in places which were infected with specific disease.

In sewer air fewer such germs have been found than in the air of houses and schoolrooms.

Moist surfaces—that is, the contents of cesspools and sewers and the walls of sewers—while emitting odors do not give off specific germs, even in a moderate current of wind.

Splashing of the sewer contents may separate some germs and then the air of the sewer may become temporarily infected, but the germ will sink to the ground again.

Choking of the sewer, introduction of hot factory refuse, leaky house drains, and absence of traps may be the causes of sewer air ascending or being forced back into the houses. But the occurrence of this complication of circumstances is certain to be rare.

Whatever rises from the sewer under these circumstances is offensive and irritating. A number of ailments, inclusive perhaps of sore throats, may originate from these causes. But no specific diseases will be generated by them except in the rarest of conditions. For specific germs are destroyed by the process of putrefaction in the sewers,

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and the worse the odor the less is the danger, particularly from diphtheria.

The contributing causes of the latter disease are very numerous, and the search for the origin of an individual case is often unsuccessful.

Irritation of the throat and nasopharynx is a frequent source of local catarrh; this creates a resting-place for diphtheria germs, which are ubiquitous during an epidemic, and thus an opportunity for diphtheria is furnished.

Of the specific germs, those of typhoid fever and dysentery appear to be the least subject to destruction in cesspools and sewers. These diseases appear to be sometimes referable to direct exhalation from privies and cesspools, but very few cases, if any, are attributable to the action of sewer air.

The impossibility or great improbability of the infection of specific diseases, except dysentery and typhoid fever, rising from sewers into our houses, protected as they are, or ought to be, by good drains and efficient traps, should, however, not lull our citizens and authorities into indolence and carelessness. For the general health suffers from chemical exhalations, and the vitality of cell life and the power of resistance are undermined by them.

SYMPTOMATOLOGY

Prodromes.—After an incubation period lasting from a few hours to fourteen days, prodromes may precede the characteristic symptoms of diphtheria from a few hours to several days; some of them are identical with those of general malaise, and nausea; occasionally vomiting, seldom other infectious diseases. They are lassitude, headache, diarrhœa, more commonly constipation; universal muscular sensitiveness, and some stiffness of the neck. The throat is complained of by older children as being dry; the mouth is easily opened, there may be no discoloration of the fauces, or a hyperæmia only which, as if it were traumatic, may be quite local. The tonsils and pharynx are seldom sensitive to the touch, but the swallowing of fluids is rather difficult. In those cases in which a swelling

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of lymph bodies is noticed near the angle of the lower jaw at this early period, there is pain on pressure. The temperature is seldom raised except in these cases; in them nervous symptoms are observed, such as chills and convulsions. There is rarely a short pharyngeal cough, still less frequently a hoarse voice, or dyspnoea, or laryngeal stridor.

SYMPTOMS

The Throat.—Most cases of diphtheria begin in the throat. The tonsils being large in the young, and exposed to superficial lesions occasioned by catarrhal processes, and to injuries of the epithelium (during deglutition), are most readily invaded by bacilli and other microbes. There may be no, or a slight, or a high elevation of temperature. This difference, like all other symptoms, depends on the various degrees of virulence of the invading micro-organisms, on the previous immunity, and on the different powers of resistance on the part of the patients. When the temperature is high (104° - 107°) there may be a convulsion, or vomiting, or sometimes diarrhoea. But these symptoms of the initial stage are rare.

The throat is red, all over in most cases, or locally; mostly on the tonsil, or near it, there is a grayish or whitish spot, the size of the head of a pin, or larger. Sometimes the first inspection reveals the presence of a membrane of the same color or brownish. The small grayish spot will increase within a few hours or a day until it grows into a membrane, or there are more than one, four or six or more, which soon coalesce. The membrane may be thin like a film, or thick; lying rather loose on the mucous membrane, or tightly adhering so that its removal is difficult and attended with a little bleeding; when it is removed it is reproduced in a few hours or half a day. The grayish discoloration is not always membranous; quite frequently it is caused by an exudation into the tissue and cannot be removed at all. Then it does not come away at any time but undergoes a process of necrosis, and if it heals at all does so only by healthy granulations springing up on the ulcerating surface. The

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neighboring tissues, mainly the uvula when it is covered with membrane, become œdematous and may swell considerably. Then deglutition, respiration, and articulation may suffer accordingly. At first the membrane has no odor. In bad cases, and after some days, when maceration begins, there is some odor, which may be very offensive and fetid in septic cases. In the neighborhood of the membranes the lymph bodies will swell, the region of the tonsils becomes painful on pressure, and there is some, or much, swelling, which depends in part on the tumefaction of the lymph bodies alone, and in part on that of the surrounding loose tissue. The face is pale and sallow, may be bloated even in mild cases, and its expression is liable to be that of indolence and apathy; in bad cases of sepsis and when the veins of the neck are compressed by exudation the color may become livid. There are but few mild cases of uncomplicated diphtheria that do not exhibit some constitutional symptoms; the pulse becomes a little frequent and small; in bad cases it is very small, very frequent, or very slow. Those cases in which the pharyngeal diphtheria spreads into nasopharynx, nares, or larynx have their own additional symptoms; they will be considered below, so will be those which terminate in destruction of tissue in the throat in consequence of deep ulceration and gangrene, which may even result (though that occurrence be rare) in perforation of the soft palate, or its adhesion to the posterior wall of the fauces.

The local symptoms of diphtheria may be very indistinct, even absent. As early as 1860 I described cases of diphtheria without membrane, this being absent either in the first stage only or altogether. At the present time the bacteriological proof corroborates what I then had ample reasons to conclude from clinical facts. The term catarrhal diphtheria has been accepted by many since, though it has been combated by others. That such cases may occur in families in other members of which well-authenticated instances of diphtheritic membranes are met with has been substantiated by many, among whom I am glad to count Baginsky. To call such cases "masked diphtheria" appears unjustifiable, so long as the diagnosis is made,

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as now, by the presence of the bacillus and of acute surface changes in the mucous membrane.

Diphtheria may, and frequently does, present itself, with its solitary dots on the tonsils, in the form of follicular or lacunar angina. Long before the advent of a bacteriological diagnosis that fact became clear to me. Still the numerical percentages of such cases will change even according to seasons and epidemics.²

This follicular form of diphtheria is often noticed in adults, and is a frequent cause of communication of the disease, the more easily as adults are less liable to suffer from constitutional symptoms. But I never said what I have been charged with, that diphtheria is spread by adults suffering from follicular amygdalitis (tonsillitis). On the contrary, what I did and do say is that what was called in an individual case by that name and then gave rise to diphtheria, was diphtheria, and therefore caused diphtheria. Nor do I say that every case of follicular affection of the tonsils is diphtheria, and that diphtheria in general is spread by follicular amygdalitis in general, but I claim that this name is too often only a cloak for the lack of a correct or complete diagnosis. "Follicular" and "lacunar" are adjectives describing a locality, nothing else. There are cases of a follicular or lacunar amygdalitis of a catarrhal, a purulent, a fibrinous, and a diphtheritic character, and the name ought to be dropped from our nomenclature, because it gives rise to mistakes unless it be complemented with a descriptive adjective (*Medical Record*, November 27, 1886). This variegated condition

² If Edmund Meyer's 55 cases of "typical" angina lacunaris gave him staphylococcus aureus in 15, a mixture of staphylococcus and streptococcus in 24, streptococcus pyogenes in 14, and Klebs-Loeffler bacillus in only 2 instances, he had an experience different from those of Lennox Browne, Koplik, and Feer ("Aetiologische und klinische Beiträge zu Diphtherie," 1894, p. 43). The latter should hold himself responsible for the following words literally translated: "It is an *established* fact that many cases of lacunar anginae are of diphtheria origina, though Jacobi's opinion, according to which that is so, has become *untenable* through bacteriological research."

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of the tonsils and pharynx was also described by me in an article "On Diphtheria and Diphtheritic Affections," in the *American Medical Times*, August 11th and 18th, 1860, and in C. Gerhardt's "Handbuch der Kinderkrankheiten," II., 1877.

The follicular form of amygdalitis (diphtheritic or other), causing local and small circumscribed alterations only, may easily be mistaken for a similar circumscribed deposit which is not in a tonsillar lacuna, but on some other part of the tonsil. This punctuated diphtheria is mostly seen in larger children, in adolescents, and in adults, for the reason that renewed attacks of pharyngeal inflammation so harden and cicatrize the tonsillar surface that extensive exudations can no longer take place. The broad statement is justified that pharyngitis creates a disposition to diphtheria and to the formation of large membranes in the very young, and rather destroys it or causes only small exudations in advanced age. But whether membrane or dot, they are equally contagious. A mild variety begets that which is mild or severe, as the severe form may produce its like, or a mild variety. This mild variety is that from which adults are apt to suffer. It made me proclaim the warning that there is as much diphtheria out of doors as indoors, as much out of bed as in bed. With this variety the adult is on the street, engaged in business, in the schoolroom, in the railroad car, in the kitchen, and in the nursery. With this variety parents, while complaining of slight throat trouble, which is not heeded, kiss their children and infect them (*Medical Record*, November 27th, 1886).

The confusion in regard to the accurate diagnosis of an individual case is caused by the difficulty of always establishing the temporary presence or absence of the Klebs-Löffler bacillus. Having noticed the frequent identity of lacunar "tonsillitis" with diphtheria, C. Fraenkel, E. Czaplewski, and others "believe" that bacilli are actually more common than is generally assumed, and that numerous alleged cases of streptococcus pseudodiphtheria are, after all, caused by the bacillus, and that, on the other hand, uncomplicated bacillary diphtheria is quite rare.

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Another cause of confusion was the assumption that genuine bacillary diphtheria was the most dangerous form of the disease. There was a time when the diagnosis of diphtheria was made by the omniscients from the termination of the case: if the patient died, it was diphtheria; if not, not. The advent of the bacillus has changed that; the bacillus case is at once made out to be the most dangerous and fatal case. Nothing is more erroneous. As a rule the uncomplicated bacillus case is not among the fatal cases; as a rule the uncomplicated streptococcus case is not fatal; but the mixed case is ominous. The elimination or non-appearance of one of these components is a favorable occurrence. The latest illustration of this fact is the report of Strassburger, who states that the large majority of diphtheria sufferers in Bonn carried Klebs-Löffler bacilli which were comparatively harmless. These mild cases were not complicated with streptococci, which were present in every grave case.

Skin.—An erythematous eruption, more or less general, appears sometimes on the skin immediately with the invasion of diphtheria, or after a few days only. It is either evanescent, scarcely visible for more than a few hours, or covers a large surface and remains some days. It has been mistaken for scarlet fever, but is not generally attended with a high temperature and with the intense stomatitis and glossitis of scarlatina; by the lower temperature it is also distinguished from the erythema which is liable in predisposed infants or children to accompany many feverish diseases.

This eruption of diphtheria does not appear to be proportionate to the seriousness of the illness. At all events it has nothing in common with erysipelas, which, however, is apt to accompany such cutaneous diphtheria as follows abrasions of the skin, and is found on tracheotomy or other wounds. Such local deposits of diphtheritic membranes are often found on the local denudations of scratch wounds, eczema sores, or vesicatories. They are apt to remain local; but, on the other hand, in many cases in which the first localization of diphtheria is in the skin, it will affect the neighboring lymph bodies and infect

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the whole body. As a rule, however, it is amenable to early and effective treatment, and that is why Trousseau declared most cases of cutaneous diphtheria to be devoid of danger.

In connection with these cutaneous alterations may be mentioned the more or less local or general emphysema which occurs sometimes during or after tracheotomy. I had that disagreeable experience a number of times, on account of my preferring to operate mostly below the thyroid gland. There the mediastinal tissue is sometimes injured, and during the intense dyspnoea a local emphysema of the subcutaneous tissue is the instantaneous result. Even from a slight rupture of pulmonary alveoli much air will escape and the whole body may become transformed, as it were, into a bulging, crepitating balloon.

Extensive oedema is sometimes noticed, even without albuminuria.

In connection with the alterations of the skin petechiæ, purpura, and ecchymoses may be mentioned, though, indeed, they might find their proper place also under the head of the organs of circulation. Like scarlatina and, still more, measles, and, indeed, all infectious diseases, diphtheria (principally the mixed bacillus and streptococcus infection), mainly when the myocardium is altered and when blood-vessels are obstructed, will result in effusion and either small or large extravasations. Beside the latter in its different forms urticaria, erysipelas, and variola-like eruptions will be observed. There is, however, no eruption that is pathognomonic of genuine diphtheria.

The local lesion of the mucous membranes gives rise to bloody discharges from the nares or the pharynx. When sepsis is very intense and gangrene deeper, actual hemorrhage will occur. The large majority of dangerous or fatal hemorrhages come from tracheotomy wounds, now and then, perhaps, from mere pulmonary hyperæmia and apoplexy, sometimes after the loosening of membranes, or from erosion of larger blood-vessels. Now and then the pressure of an improper tracheotomy tube would cause it, as in Ganghofner's and in Maas's cases of hemorrhage from the innominata, sometimes the septic destruction of

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a carotid artery, as in a case described by me (Transactions of the Association of American Physicians, 1898), or that of other large blood-vessels would lead to a fatal termination from profuse bleeding.

Nose.—The diphtheritic membranes spread quite often from the throat to the nasal cavities, mainly when the posterior aspect of the uvula is affected. The latter's frequent contact with the posterior wall of the pharynx during deglutition exposes the posterior wall of the pharynx as well. In many such cases the membrane is very thick and dense, and apt to obstruct the nasal passages sometimes to such an extent as to close them entirely. Usually there is no or very little nasal discharge; but articulation becomes "nasal" and the voice "thick" very soon, and respiration is hampered. The deep facial lymph bodies near the angle of the lower jaw are more or less swollen. Whenever they are so, the nasopharynx should be examined.

Primary diphtheria of the nose (diphtheric or diphtheritic rhinitis) is of frequent occurrence. Either without any prodromi, or during or after an acute or a chronic nasal catarrh, with much or with little discharge, there is a thin, serous, or slightly flocculent secretion which is more or less profuse, sometimes not, sometimes slightly, other times intensely fetid. Hence, during the prevalence of a diphtheria epidemic, every nasal (or pharyngeal) catarrh requires immediate attention. This primary form may also lead to the exudation of thick membranes, as described above; the general consecutive symptoms so much to be dreaded do not depend, however, on the thickness of the membranes. On the contrary, in many cases with only thin membranous deposits the lymph bodies are more affected, and the effect of the toxin becomes painfully visible in the either very slow or rapid and feeble pulse with all the other symptoms of a generalized sepsis. The cervical adenitis has but little tendency to suppuration; but a gangrenous degeneration takes place mainly in the mixed infections, or chronic hyperplastic infiltrations tell their tales for years to come. There is no more dangerous form of diphtheria than that of the nares. Still more, however, than the foul-smelling cases are to be feared

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those which exhibit few membranes, but at an early period a sanguinolent discharge. In these not even the lymph bodies may swell, but absorption will take place directly through the blood-vessels, which are open, as is proved by the very presence of blood in the discharges.

So long as the final clinical diagnosis of diphtheria depends on the presence of the bacillus, if found, in the membrane or in the discharge, the numberless papers strutting about the magazines to prove either the innocuousness or the dangerousness of fibrinous rhinitis, or again the presence or absence of bacilli in fibrinous rhinitis, or its ability or inability to cause faucial or laryngeal diphtheria, are superfluous vaporings of single observations. Whenever nasal diphtheria is diagnosed in any of its forms, or even strongly suspected, danger should be assumed to exist. In most cases the infection is mixed, very mixed. Edmund Meyer (*Archiv für Laryngologie und Rhinologie*, IV., 1896) found in twenty-two cases of "fibrinous rhinitis," nine times streptococci and staphylococci albi and aurei, and thirteen times Klebs-Löffler bacilli; Guarnaccia, in his cases of "caseous rhinitis," found Klebs-Löffler bacilli, streptococci, staphylococci aurei and albi, sarcina lutea, bacillus subtilis, bacillus proteus, leucocytes containing microbes in their nuclear protoplasm, and streptothrix alba.

The *conjunctiva* of the upper (more frequently) or the lower eyelid becomes diphtheritic either primarily or secondarily (when the nose and lacrymal ducts are primarily affected). Diphtheritic conjunctivitis is not a frequent disease—sometimes I do not see a case in a year; thirty-five years ago it was frequent and destructive. Evidently the epidemics differ in regard to virulence. Usually the membrane spreads rapidly from one eyelid to the other; when the palpebral conjunctiva is smooth, dry, and pale, while that of the bulbus is chemosed, the whole lid becomes red, swells and stiffens, and a membrane is first deposited in floccules, which soon coalesce into solid masses. These are so thick as to press upon the cornea, which speedily becomes hazy and ulcerates. Perforation takes place, the iris prolapses, and sometimes the eye is destroyed within

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a single day. It takes the membrane a few days to begin maceration.

The accurate diagnosis of the character of the membrane should be made in the usual way; in many cases simple film preparations, to the exclusion of cultivation, are sufficient. It is claimed by Moray (*Annales d'oculistique*, April, 1895) and Sydney Stevenson (*British Medical Journal*, June 18th, 1898) that quite often the discharge from the eye contains only that microbe which is the cause of the inflammation. There is only one source of confusion likely to arise, viz., that between Klebs-Löffler and xerosis bacilli.³

According to Ammann⁴ the cornea may be affected by the Klebs-Löffler bacillus, alone, but is mostly invaded only when strepto- and staphylococci are present. Once he found non-virulent bacilli together with the virulent.

The ear is liable to take part in the diphtheria of the nasopharynx. Membranes may continue into the funnel-like aperture of the Eustachian tube, which in the young is relatively larger than in the adult, or the specific catarrh (a mere surface diphtheria) may extend into the

³ The main points of distinction are (according to Stevenson): 1. Both stain by Gram's method, but the diphtheria organism loses its gentian violet, when in alcohol, much more quickly than the xerosis bacillus. 2. Klebs-Löffler bacilli give rise to an acid reaction when grown in neutral bouillon or milk, while xerosis bacilli never do. 3. The latter, when inoculated into guinea-pigs, cause nothing more than a swelling at the site of the puncture.

⁴ The xerosis bacillus is believed by Schanz to be identical with the Klebs-Löffler. Its microscopical features vary, but not more so than those of the latter and of the "pseudobacillus." It differs in this also that, though it is always combined with streptococci, it is not believed to be virulent, inasmuch as it does not cause diphtheria. Still, there is a case of von Hippel—examined by C. Fraenkel also—which proved the virulence of the xerosis bacillus. It was met with in the conjunctival sac of a man who had been operated upon for cataract. It was found to be very virulent in animal experimentation, though on the eye of the patient there was no kind of inflammation, least of all diphtheria. The absence of diphtheria, however, in the presence of Klebs-Löffler bacillus on mucous membranes is a frequent occurrence.

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middle ear. Since I collected what little literature there was in 1880 ("Treatise," p. 75), instances of that kind have multiplied. The drum membrane, the external meatus, and the lobes are subject to diphtheria when the surface epithelium has been injured. A complication with erysipelas I saw thirty years ago on the external ear of a newly-born child; in older children I have seen that same unfortunate complication during bad epidemics; also, without erysipelas, a gangrenous disintegration of the cheek, of the external ear, sometimes down into the bones, with all the possibilities arising in the various forms of otitis media and osteitis. While some died of sepsis, others would succumb to thrombotic obstructions of a sinus.

The *kidneys* are liable to participate in most infectious diseases, even in the common forms of pharyngitis; in none more so than in diphtheria, no matter whether mild or grave. Evidently the irritation caused by the elimination of the toxin damages either merely the functions or the substance of the kidneys. Albuminuria is seen early, about the third or fourth day, even on the second, in perhaps one-third of all the cases, while the quantity of the urine is rarely diminished, sometimes increased. Blood there is very rarely, even in septic cases less frequently than in scarlatina. Urea is present in normal or fair quantities, and the salts are nearly normal. Cylindroids (mucin) and sometimes hyaline casts are found in these simple cases in which the albumin may be present a few days or a week, without exerting an influence on either the temperature or the other symptoms. Sometimes, after having been quite copious, it disappears very suddenly.

Actual nephritis is not so frequent as in scarlatina, but it occurs. Hyaline casts in larger numbers, turbid cells, small granular casts are the first microscopical symptoms, which may be followed by large granular casts and occasionally only a few red blood cells. The urine becomes scanty, the skin more pallid, the collapse more intense. In this nephritis of diphtheria there is less œdema, less dropsy, less uræmia than in that of scarlatina or other complications. Convulsions are not even so frequent in

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this stage as they may be in the incipient stages of such cases as begin suddenly and with a high temperature. The patients die, now and then, without losing consciousness to their last hour. A fatal termination is not so common as in other complications. When albumose is found, together with considerable albumin, Berlin (*Münchener medizinische Wochenschrift*, No. 42, 1897) believes the prognosis to be rather favorable. Still in most of the cases at the clinic of Strassburg in which he made his observations, the renal complications were only trifling.

The *bronchi* and the lungs participate in various ways and at various times. The pseudomembrane, whether streptococcic or bacillary, descends into the ramifications of the air tubes, or it is first formed in these, where it may become localized or whence it may ascend. This "fibrinous bronchitis" may run a rapid or a slow course. After the pseudomembranes have been thrown off, a mucopurulent inflammation may remain and prove dangerous to the exhausted patient. Pulmonary oedema, with intense bronchial hyperæmia and extensive dilatation of the blood-vessels, results from the rarefaction of air in the lungs during laryngeal obstruction. This form can be best observed during a tracheotomy when it is made after a long duration of stenosis; an incredible amount of oedematous fluid will ascend from the trachea under such circumstances. The intense bronchitis accompanying it is frequently the forerunner of elevations of temperature and of bronchopneumonia within one or two days. Broncho- or fibrinous pneumonia may also follow the aspiration of membrane (as well as of food) during dyspnœa. The microbic nature of the membrane determines frequently the microscopic character of the consecutive pneumonia, which may be simply pyococcic but appears to be mostly attended with or caused by the Klebs-Löffler bacillus (Wright, Kanthack, Stephens, Flexner). In the septic form, or under ordinary circumstances also, a gangrenous pneumonia has been observed. Most pneumonias observed in diphtheria accompany, or are dependent on, the laryngeal form (croup). That is why percussion and auscultation do not yield so conclusive results in such cases; for dulness may be found

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over a merely atelectatic area, and the respiratory murmurs are obscured by the transmitted sawing, loud, laryngeal sounds. Still when the hitherto low temperature is replaced by a high one, and the normal long-drawn inspiration of uncomplicated laryngeal diphtheria (croup) gives way to great frequency of respiration, the suspicion pointing to pneumonia becomes almost a certainty.

Like strepto and staphylococci the Klebs-Löffler bacillus is found in tuberculous lungs. It is easily seen that, as it is frequent on the mucous membranes of the upper part of the respiratory organs, it may readily appear in its lower distributions. Whether it modifies the tuberculous disintegration remains an open question. The influence of the streptococcus on the tuberculous process is assumed by all to be powerful for evil. While it is possible and appears to be proven that the presence of streptococci interferes with the growth of Klebs-Löffler bacilli, other observations have shown that under certain circumstances the non-virulent bacilli may become virulent under the influence or in the presence of streptococci (Schütz in the *Berliner klinische Wochenschrift*, April 18th, 1898).

The *œsophagus* rarely participates in the diphtheritic affection of the pharynx beyond a distance of from 2 to 3 cm. where its tissue is healthy. If it is not healthy, for instance near cicatricial contractions, membranes may be found at any place. They may be deposited loosely on the mucous membrane and easily floated, or may be embedded in the tissue, and then lead to necrosis.

The *stomach* participates in the symptoms of incipient diphtheria by vomiting, which, however, is not frequent. Gastric pain and vomiting may precede cardiac paralysis. Membranes, however, are found in exceptional cases only. In one I concluded they were swallowed before death. The *intestinal tract* has diphtheritic (dysenteric) membranes in the rectum and colon, sometimes in connection with pharyngeal (and nasal) diphtheria. Mixed (bacillus and streptococcus) infections are sometimes complicated by a septic diarrhœa with gangrenous fœtor, and at the same time with purpura, nephritis, and intestinal hemorrhages. Schwabe has reported the case of a physician who died

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of a septic diarrhœa contracted by swallowing membranes aspirated from a tracheotomy wound.

The cases of diphtheria of the *bladder, vagina, and penis* recorded by me in my "Treatise" of 1880, pp. 86-90, do not bear perhaps the present test of bacteriological diagnosis. But several cases, so verified, or diphtheria of the vagina, and of circumcision wounds have been seen by me since. One of the former was met with in a case of nasopharyngeal diphtheria, two of them were followed by a faucial affection, one of these was puerperal. The inguinal lymph bodies were not much affected, but a slight swelling I never missed. One patient with diphtheria of a circumcision wound, neglected and gangrenous, died with large inguinal adenitis. Nisot, Bumm, and J. Whitridge Williams (*American Journal of Obstetrics*, August, 1898) report cases of diphtheria of the vagina (and uterus). In the case of the latter the woman was (possibly) infected by the physician. Her new-born baby and several other children caught the disease from her, and the baby died.

There is rarely a case of diphtheria in which the *lymph bodies* in the neighborhood of the diseased locality are not affected. The latter determines the swelling which is to take place. Previous remarks explain why a diphtheria limited to the tonsils does not cause much swelling of the lymph bodies, or why that of the vocal cords when uncomplicated exhibits no secondary adenitis at all, and why a nasal diphtheria with sanguinolent discharge from open blood-vessels, though constituting a formidable variety of the disease (the toxin being introduced directly into the blood circulation), should show no tumefied lymph bodies. These are irritated by the absorption from the diseased surface, the swelling corresponding both to its locality and the gravity of the case. Bacillary diphtheria, not or but little complicated with streptococci, shows less adenitis than when the affection is thoroughly mixed. Simple streptococcic membranes yield more adenitis than a mild bacillary diphtheria. That is why so many cases of scarlatina in which the complication with streptococci is more frequent than that with bacilli, have more faucial

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and cervical tumefaction than diphtheria. Suppuration is less common in the Klebs-Löffler affection—Lennox Browne's opinion notwithstanding—than in the streptococcal or in the mixed infection. Large abscesses are not frequent. Though the swellings be ever so immense in mixed infections, they do not abound. There may be many of them, but they are mostly small. The degeneration which takes place is rather a necrosis and gangrene than suppuration.

The seat of the adenitis corresponds with that of the diphtheria. The posterior nares correspond with the deep-seated lymph bodies below and near the angle of the lower jaw to such an extent that this diphtheria, though no membranes be visible, may thus be diagnosticated. In very grave cases the swelling will even extend to the parotid.

The *heart* is probably affected in every case of diphtheria. In Gerhard's "Handbuch der Kinderkrankheiten," Vol. II., 1877, I mentioned the symptoms with their anatomical foundation which I characterized as extravasations, cellular and nuclear alterations (myocardial), and endocarditis, first mentioned by Bridges. Among 17 autopsies recorded by Reimer there was fatty degeneration of the heart in 6, and ecchymosis of the myocardium in 3 cases. In addition to frequent hyperæmia of the abdominal viscera there were emboli of the liver in 3, with capillary hemorrhages in its peritoneal covering in 1, and emboli in the spleen in 5 cases.

The symptoms do not always correspond with the tangible anatomical changes. The results of the thousands of anatomical and microscopical examinations which have been made these forty years, though they be insufficient to explain the physical foundations of the morbid symptoms, do not justify the establishment of a "diphtheritic fever," which I resorted to in 1860 for the purpose of classifying just such cases in which the symptoms did not appear to be based on palpable changes. There is no case ever so mild apparently that will not affect the heart's function at once to a certain extent. From mild cases to the gravest there are gradual transitions. The skin is pale, yellowish, livid, cyanotic, sometimes the lividity and cya-

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nosis are quite localized, the pulse is feeble, mostly frequent; in bad cases sometimes slow, often irregular and intermittent; in the worst cases filiform when near or over 200, apparently of normal volume (still compressible) when quite slow (30 to 50), sometimes dicrotic, or galloping. The heart is sometimes still more irregular than the arterial pulse. Its transverse diameter is enlarged, mainly over the right ventricle; the sounds are muffled and drawn out, and in this way audible over a large surface. Real bellows murmurs, when localized, are met with in endocarditis only. The complex of symptoms belonging to actual parenchymatous myocarditis will generally not set in before the end of the first week. Turbidity of cell structure, fatty or waxy degeneration, and loss of cross striation are the anatomical changes which have been verified hundreds of times; they correspond to a certain degree of cardiac incompetency and are probably due to the influence of the diphtheria toxin only.

Mollard and Regaud (*Annales de l'Institut Pasteur*, 1897) found affection of the myocardium, together with changes in other viscera, in every one of their eighteen cases of experimental diphtheritic intoxication. Occasionally it was confined to the muscular tissue, which became abnormally striated and sometimes, through disintegration of nuclei and protoplasm, was destroyed. Others report the presence of numerous nuclear alterations in the cardiac muscle (Kretz), another (Hibbard, Boston City Hospital, 1898) "in the vagus some evidence of degenerative changes."

The *liver* is enlarged and easier to feel than the spleen. Its size and resistance may increase tremendously when the circulation becomes sluggish under the influence of general exhaustion and sepsis, and of myocardial changes. Jaundice is met with in very grave and septic cases.

The *spleen* is enlarged in most cases, but difficult to palpate because of its softness, and to percuss because of the tympanites which frequently attends the disease. Even under normal circumstances the percussion of the spleen in the very young is not a successful procedure.

In Reiner's cases the *blood* was frequently normal, very

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often watery and dark, at times leucocytotic; the latter condition was also noticed by Bouchut and Labadie-Lagrave. Wunderlich reported two cases of Hodgkin's disease which developed during diphtheria; Bouchut and Dubrisay found leucocytosis with considerable disproportion in the number of red and white cells, which, however, was not great enough to justify the diagnosis of leucocythæmia. Many examinations of the blood have been made since, all with similar results. Thus Gabritchevsky found hyperleucocytosis in every case of diphtheria. It is greatest in fatal cases; during convalescence and after the injection of antitoxin it diminishes. A progressive hyperleucocytosis in diphtheria justifies a bad prognosis, and the analysis of the blood gives useful information regarding the value of treatment. Ordinarily the white cells vary between 11,450 and 25,000, and in fatal cases between 29,500 and 51,000. J. L. Morse, who quotes Gabritchevsky, comes to similar conclusions (Boston City Hospital Reports, 1895).

The *nervous* system is profoundly affected by diphtheria. During the first days of a pharyngeal diphtheria the soft palate may so swell as to interfere with respiration and deglutition. In most cases an improvement will take place with the restitution of the tissues to a fairly normal size, and the local paralysis will be only apparent. In other cases this apparent paralysis may change into an actual one in the second or third week or later. Usually, however, the difficulties of respiration and deglutition are moderate—indeed, paralysis is liable to follow apparently mild cases in preference to those which exhibit a vast amount of pharyngeal exudation—and after convalescence has actually set in or progressed for some time a peculiar array of symptoms will make its appearance. Usually the paralysis begins in the throat, the uvula appears elongated, the soft palate becomes gradually immovable, articulation is nasal, deglutition becomes difficult, fluids instead of being swallowed may be discharged through the nose, or, when the muscles of deglutition are becoming paralyzed, run down the larynx and cause cough and pneumonia. This paralysis of the soft palate is mostly bilateral, sometimes uni-

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lateral. A week or two after the beginning of the pharyngeal paralysis, often while it is getting better, the accommodation of ocular movements becomes faulty in consequence of the symmetrical paralysis of the ciliary nerves (Eulenburg). Paralysis of the internal and external rectus are less symmetrical. The pupils are not affected, other branches of the motor oculi and the abducens but rarely. Total ophthalmoplegia has been observed in a few cases only. After thousands of similar observations have been made, the observations of Scheby-Buch are still classical. Of 38 clinical cases of paralysis of accommodation 24 resulted from diphtheria; of these 20 were located in the throat, 3 started from wounds, 1 from the vagina, 1 from the skin. There was no mydriasis, with one exception. Refraction, which was invariably diminished, and vision, which was slightly impaired, became normal again with the restoration of health. This paralysis of accommodation was complicated with paralysis of the palate in 10 cases, in 9 cases it was uncomplicated, as in many other instances noticed before and after Scheby-Buch. Sometimes it would occur several or many weeks after the appearance of the pharyngeal paralysis.

Next in the usual order is paralysis of the muscles of the trunk and of the upper and lower extremities, frequently preceded by paræsthesia or anæsthesia of some or all the fingers and the palm (and other parts of the hands) and feet, also of other parts of the surface. These affections of the sensitive nerves may be quite local. I have met with anæsthesia of the trunk. Even the sensory nerves may become paralytic, the organ of taste in a case of Magne's; more instances may be found in my "Treatise," p. 101, in some of which the sensitive changes were such as to cause ataxia. The temperature sense has been found diminished sometimes. The motor paralysis of the extremities may increase until the limbs are entirely useless for weeks; as a peculiar mitigation may be mentioned the comparative immunity of the fingers in many cases.

The sphincters of the bladder and of the anus are rarely affected, likewise the muscles of the larynx and the respiratory muscles. When both the external respiratory mus-

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cles and the diaphragm are mildly taken there is cough, flapping thoracic respiration, and some dyspnoea. In severe cases the patient dies of apnoea, sometimes suddenly. Peristalsis is rarely paralyzed; but a single case of extreme constipation has come to my notice, and Baginsky, with his ample opportunities for observation, has seen a few only. Hemiplegia is found but rarely, and scarcely at all in the very young. One such case has been published by J. W. Branan. This writer says: "There are thirty-five cases in all recorded in medical literature of postdiphtheritic paralysis of cerebral origin. Six cases have come to autopsy; in one of these a hemorrhage was found in the internal portion of the lenticular nucleus, with destruction of the neighboring part of the internal capsule. In the other five cases there was embolism of the Sylvian artery. . . . In the total thirty-six cases there was complete recovery in four, death in seven; in all the others there was permanent paralysis of greater or less extent."

A case of acute disseminated sclerosis of the spinal cord, with neuritis, in diphtheria has been recorded by S. G. Henschen (Berlin, 1896).

The peripheral nerves act according to no rule. Sometimes the knee reflexes are diminished or absent early, at other times late. Reaction of degeneration is quite common in advanced cases, but will disappear in the course of the general recovery.

In the beginning of a diphtheria the prediction that paralysis will follow or not cannot be made. The very worst cases may be spared, mild ones will often be followed by paralysis; the latter fact has been substantiated in certain experiments made by Heubner. The location of the diphtheritic process is indifferent in regard to paralysis; it was found twenty-five years ago by Gayton, Scheby-Buch, and myself, also by Maingault (1854, 1859), who deserves the credit of having added most (after Bretonneau) to our acquaintance with diphtheritic paralysis, to be connected with diphtheria of the genital organs. The cause of paralysis is not local, but general and toxic. In some seasons and epidemics the percentage of diph-

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theritic paralyses is quite high (ten to thirty), in others low; that is why the figures belonging to a long series of consecutive cases only should be considered. Now and then the order in which the symptoms of paralysis follow each other is not disturbed; but sometimes precisely the contrary holds good. Indeed, in many seasons it is characteristic of diphtheritic paralyses to follow no certain course, passing by some parts of the body and attacking others.

The unexpected occurrence of sudden death in diphtheria has sometimes been discussed in connection with the nervous system, at other times with the heart. At all events it is the result of a cardiac paralysis, due to a change either in the ganglia or in the pneumogastric or in the sympathetic fibres. My first case of the kind was observed in 1857 and described in Gerhardt's "Handbuch," II., also in my "Treatise," p. 94. No explanation was found at the autopsy. It occurred before Zenker, Hiller, and Mosler described parenchymatous inflammation and granular degeneration of the heart muscle, and before the anatomical causes of defective or interrupted innervation were the subject of much study. Afterwards those changes described by Zenker in connection with all sorts of infections and feverish diseases, also amyloid degeneration, or heart clots formed by incompetent muscular action of the heart, or thrombi resulting from sluggish circulation in distant small veins, or such as form in the small veins of the neck during the labored respiration of croup, were accused together with defective or paralyzed innervation. Buhl found also apoplexies in the spinal ganglia and in the gray substance of the spinal cord. As but few patients die of or during diphtheritic paralysis, the opportunities for making autopsies are comparatively rare. Still, before 1880, a number of observations were made which compare favorably with the results of modern researches. Buhl found considerable thickening of the spinal nerves at the junction of the posterior and anterior roots, with hemorrhages and diphtheritic exudation in the superficial connective tissue in these places. Oertel described in the sheath of the nerves in the cerebral and spinal meninges and in

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the gray substance of the cord voluminous nuclear infiltration, in one case extensive hemorrhages in the spinal meninges, with nuclear proliferation in the gray substance of the cord; Pierret found disseminated meningitis with perineuritis of the neighboring roots, characterized by infiltration of nuclei between the nerve fibrillæ; Charcot and Vulpian, degeneration of the palatine nerves and fatty disintegration of the palatine muscles; Dejerine, atrophy of the anterior-roots secondary to a myelitic degeneration of the ganglia of the anterior horns; also in two cases liquefaction of myelin and loss of axis cylinders in intramuscular nerves.

The changes caused by diphtheria in the nervous system as described by one of the very latest writers on this much discussed subject (John Jenks Thomas, Boston City Hospital, 1898) are: 1. Marked parenchymatous degeneration of the peripheral nerves, sometimes accompanied by an interstitial process and by hyperæmia and hemorrhages; 2. Acute parenchymatous degeneration of the nerve fibres of the cord and brain; 3. No changes or but slight ones in the nerve cells; 4. Acute parenchymatous and interstitial changes in the muscles, especially in the heart muscle; 5. Occasional hyperæmia or inflammation or hemorrhages in the brain cord, or in rare cases severe enough to produce permanent troubles such as multiple sclerosis or hemiplegia. The writer adds that cardiac death probably takes place through the action of the toxin on the cardiac nerves. It is evident that the last twenty years have not added much, if anything, to the findings of the authors of decades ago.

To this may be added the results of some late experimentation. When B. Mouravieff injected diphtheria toxin into the subcutaneous tissue or into the peritoneum of guinea-pigs, acute or chronic symptoms made their appearance. Among the former were, in the ganglion cell of the anterior columns of the spinal cord, peripheral chromatolysis and extensive vacuolization, but no anæsthesia nor paralysis; among the latter were paralysis and more neuritis than ganglion-cell changes. Extensive peripheral neuritis was found only after five or six weeks.

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PROGNOSIS

Epidemics differ. In some, mostly on account of the prevalence of mixed infections, the mortality is high, in others it is low. The last few years, not through the influence of antitoxin only, have been decidedly favorable, compared with many epidemics since 1858. The prognosis should always be considered uncertain, if only for the multiplicity and variety of possible complications.

Previous good health and vigor do not insure a good prognosis. Not infrequently a system accustomed to suffering, or perhaps immunized against known and unknown infections, though the general condition may seem unfavorable, will escape destruction, while a robust child will soon succumb. That is why the rich suffer at least as much as the poor. But when the infection is at an end, convalescence is speedier and more uninterrupted in the vigorous and well-to-do. Probably the external circumstances, better air, change of room, more thorough disinfection of rooms if there was a previous case, have a good deal to do with that result.

Very young age is unfavorable. The mortality is greatest below the first year of life, very large between the third and fourth, low after the eleventh or twelfth.

Children are more liable to suffer than adults. Very old people are almost immune; still I have seen a man of eighty-six years who had diphtheria and recovered. Very young infants are less subject, though, when they are taken, more endangered than children of from one to five years; still in 1880 I reported and quoted cases of diphtheria which occurred in the newly-born. In regard to morbidity there appears to be no difference as to sex; mortality, however, has always been greater in boys. Among infants less than seven or eight months old the majority of cases occur under the third month.

In the child the mucous membrane of the mouth, throat, and nose is very soft and succulent; catarrhal and inflammatory changes with their epithelial alterations are frequent; the nasal cavities are narrow; the tonsils are comparatively large, indeed they are but rarely covered by

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the anterior pillars. Thus invasion and retention of bacilli are facilitated. The large size and number of the lymph vessels predispose to the absorption of toxins when formed. Children who are able to creep and to walk do not excel in cleanliness. Their fingers are equally well acquainted with their nares and their mouths as with the dust, dirt, and parasitic deposits on the floor of the room. Their lips are tentacles which examine and lick the crumbs on the floor, the toys in the dust, many of which are of wood or of felt and harborers of dust and microbes. Their faces and hands are seldom clean, and their handkerchiefs and towels are common property.

Such babies as cannot creep or walk are safer because they are mostly kept away from the floor and in their beds; they are not in intimate contact with their equals and possible sources of infection, but are nursed by adults. Their food is breast milk, or when artificial it is boiled. It was noticed a long time ago by Home and Canstatt that babies at the breast had but little disposition to "croup." Indeed such infants are not so subject to any of the contagious and infectious diseases as older children. Perhaps Schmid and Pflanz (*Wiener medizinische Wochenschrift*, No. 42, 1896) are correct in their opinion that *woman's* milk contains antitoxic materials; perhaps the immunizing alexins of the blood serum in the newly-born are sufficiently powerful to guard against infections to a certain extent.

After the third month of life there is a copious secretion, slightly acid, from the mouths of infants. Both its quantity and its reaction militate against microbic invasion; that is why at that period diphtheria is less common than even in the first period of life; even a common angina is not frequent unless in cold seasons or after sudden changes of temperature, or when originating from a nasal catarrh which is of frequent occurrence.

The prognosis is favorable when the affected surface is not extensive and not in very intimate connection with the lymph circulation. That is why uncomplicated diphtheria of the tonsils and local cutaneous diphtheria, which latter is very amenable to treatment, are apt to be mild.

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Diphtheria of the lips and cheeks is of fair prognosis, partly because of the accessibility of these parts and partly because of the facility with which the natural secretions macerate and expel the membranes.

The thickness and solidity of the pseudomembrane are not bad in themselves. Even in the nose a massive membrane is not so dangerous as the thin, flocculent, putrid or sanguinolent discharge. Recoveries will occur though solid deposits fill both nares and have to be removed with probes and pincers. Fetid discharges need not be fatal, and bloody oozing which facilitates the direct absorption of toxins into the circulation may be successfully treated with irrigation, as taught by me these nearly forty years, when conscientiously made. Nor does the foul and sweetish odor of the breath justify a fatal prognosis, such as Roger, Oertel, and Kohts would pronounce. Everything depends on the accuracy and efficacy of the local disinfection. Still, nasal diphtheria when not interfered with is more fatal than even the laryngeal form.

Large swellings of the lymph bodies near the affected surface are ominous. They are not so frequent in uncomplicated bacillary diphtheria, as when the process is complicated with staphylococcic infection. Streptococci are still more dangerous—Variot's latest opinions as expressed in his "*Diphthérie et Sérumthérapie*," 1898, notwithstanding—on account of the early septicopyæmia which is apt to complicate the case. This mixed infection is mostly observed in diphtheria of the nares and nasopharynx. The frequently immense swelling of the lymph bodies near the angles of the lower jaw, together with periadenitis, is dangerous and will very seldom get well unless through the most careful disinfection of the original seat of the toxic infection. The outlook improves with the diminution in size of the lymph nodes and the accompanying periadenitis.

The degree of danger does not rise or fall with the temperature of a case. High fever attends sometimes a moderate catarrh of the pharynx, always a deep-seated inflammation of a tonsil—that is how an acute merely follicular "tonsillitis" may be distinguished from genuine

diphtheria—and a general catarrhal laryngitis. A “pseudo-croup” is therefore liable to set in with a high temperature; a laryngeal diphtheria is not attended with fever so long as it is local and uncomplicated. Still, an attack of diphtheria may set in with a high temperature—even convulsions are observed, partly occasioned by high temperature, partly by toxin—which will fall with the speedy elimination of the toxin. Low temperatures do not mean a mild character of the infection; on the contrary, a low temperature may attend cases of great gravity. Subnormal temperatures are very ominous; they accompany asthenia or collapse. If a moderate temperature be followed by a sudden rise, this may signify a sudden extension of the disease, but means usually the advent of a complication in a distant organ. A cold, clammy surface is a sign of bad prognostic import.

The pulse is very variable. It is seldom proportionate to the respiration, being usually more rapid. So long as it is of fair volume, and not too much out of proportion to the temperature of the body, the heart is strong enough; as soon as it becomes rapid and feeble, and moreover irregular, the prognosis becomes more grave. Under these circumstances the most active stimulation is demanded. In some instances the weak heart is not even able to multiply its beats, and the pulse becomes slow—a most dangerous symptom. If a frequent, compressible, and intermittent, or a slow and intermittent pulse be met with, together with a puffy, leaden, apathetic, and cachectic face, the prognosis is quite bad.

All of these symptoms mean a deterioration of the heart's action either by the direct effect of toxin on the nerves—a genuine cardio-pulmonary paralysis—or by the presence of clots in the heart, of myocardial disintegration, or of a real ulcerous endocarditis. The latter is, however, more commonly the result of a streptococcal than of an uncomplicated bacillary invasion.

Affections of the blood-vessel walls leading to petechiæ or ecchymoses imply a bad, but not a fatal, prognosis.

The otitis media accompanying or depending upon diphtheria is prognostically not so bad as that which is ob-

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served in measles or scarlatina. Though deafness is not an infrequent outcome, operations are not so often demanded. Meningitis may occur in the contiguity of the tissue or by lymph communication; in either case it originates from the pharynx or from the nares, and often passes through the cribriform plate.

Pulmonary complications impair the prognosis. Broncho- or croupous pneumonias, many of which are caused by aspiration of more or less septic material, pulmonary hemorrhages, atelectasis caused by local impediments, and nervous incompetency are dangerous. The descent of membrane from the larynx or the spontaneous formation of membrane in fibrinous (not always diphtheritic) bronchitis is dangerous.

Paralysis of the laryngeal muscles and the presence of pseudomembranes in the larynx ("croup") are grave complications. There was a time when almost every patient was doomed, viz., before tracheotomy was introduced by von Roth, Krackowizer, and Voss into American practice. Even then the prejudice against the operation was great. When I performed it frequently after 1860 a famous surgeon was known to ask in all seriousness whether Dr. J. did not cut too many throats. Its results were impaired by improper procrastination and by the septic character of many of the epidemics. Improved antiseptics in tracheotomy, and O'Dwyer's intubation, which has almost entirely replaced the former operation, and its combination with the use of antitoxin have so much reduced the mortality of laryngeal diphtheria that old statistics have lost all except their historical value.

Albuminuria, which is often observed on the third or fourth day of the disease, is not by itself a grave symptom. Large quantities of albumin will sometimes disappear in a single day or in a few days—as they will occasionally do in other affections of the throat. So long as the amount of urine and the percentage of urea are normal or nearly so, the danger is trifling. But the presence of many epithelial cells, large casts, or blood, diminished or absent micturition, and perhaps even green or fecal vomiting, are grave symptoms. The intactness of the cerebral faculties

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during these attacks of nephritis should not be taken as a mitigating sign. In many cases and in many different epidemics I have seen consciousness preserved until within a few minutes before death. It is fortunate that actual nephritis is not so common in diphtheria as it is in scarlatina; altogether diphtheritic nephritis is not fatal to the same extent as the same disease when occurring in scarlatina.

The average case of diphtheritic paralysis permits of a fair prognosis. The patient generally gets well in from six to eight weeks under proper treatment. Extensive neuritis with fatty degeneration of the myocardium may paralyze the heart; paralysis of the pharynx and of the vestibule of the pharynx may lead to aspiration pneumonia; ciliary paralysis may remain permanent; that of the respiratory muscles may cause apnoea and death, and that of the sphincters of the anus and of the bladder, in the rare cases in which they have been observed, or of the spinal cord (tabes, hemiplegia) may last forever. That is why the prognosis in every case of diphtheria should be a guarded one until recovery is found to be complete.

TREATMENT

Preventive Treatment.—Prevention is partly the business of the physician, but should be mostly that of the individual, or of the complex of individuals, viz., the town, state, or nation. A child sick with diphtheria must be isolated, though the case appear ever so mild, and if possible the well children should be sent out of the house. If that be impossible, let them remain outside, in the open air, as long as feasible; let them sleep in the most distant part of the dwelling with open bedroom windows during the night, and let their throats be examined every day. The watchful eye of an intelligent father or mother may discover deviations from the norm, so that the physician can be notified. Let the temperature of the well children be taken once a day, in the rectum. The expenditures of a few minutes of a mother's time will be repaid by the discovery of a slight anomaly, which may require the presence of the phy-

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sician. Happily, there are many mothers who keep and value a self-registering thermometer as an important addition to their household articles. The attendant upon a case of diphtheria should not come in contact with the rest of the family, particularly the children, for the poison may be carried, although the carrier remains well or apparently well. The physician should see the well or suspected child before he visits the patient. Though not in protracted contact with their patients, medical men should use reasonable caution. Those visiting a diphtheria ward or a diphtheria patient should wear a clean linen cap or coat, or a rubber garment. E. M. Buckingham (*Boston Medical and Surgical Journal*, February 14th, 1895) disinfects the soles of his boots after leaving his ward, and soaks his hands and wrists in a solution (1:1000) of corrosive sublimate which is allowed to dry. Unnecessary petting of the patient on the part of the well ought to be avoided, kissing must be forbidden, the bedclothing and linen are to be changed often and disinfected, and the air must be kept cool and often changed.

During the epidemic of diphtheria, and in families stricken with diphtheria, the boiling of water and milk should be enforced.

The well or apparently well children of a family in which there is diphtheria must not go to school or to church. The former necessity is beginning to be recognized by the authorities and teachers and also, in consequence of compulsion, by parents; but I have seen children after being excluded from the schools taken to church. Schools ought to be closed entirely when many cases have occurred. Even when the school children have not been extensively affected, but a diphtheria epidemic has commenced in earnest, it will be better to close the schools for a time. If that be not advisable, the teacher ought to be instructed to inspect throats, and directed to examine every child in the morning, and send home every one barely suspected. This is not superfluous even where a regular medical inspection has been introduced, as in New York City.

The Board of Health of the State of New Jersey has

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issued the following school regulations, which, if obeyed, cannot fail to have a good influence and should be adopted by similar authorities.

"I. Each day during the prevalence of infectious disease, after the school is dismissed, the janitor is to scrub with warm water, soap, and a stiff scrubbing-brush all parts of doors, casings, and other woodwork which can be touched by the hands of children. II. The floor should be in good repair and without open cracks or crevices. It should be sprinkled with clean water daily before being swept. III. Lead pencils (there should be no slates) should every day be immersed in a five-per-cent. solution (1:20) of carbolic acid and wiped dry. IV. Books which have been used by a pupil who is suffering from any one of the communicable diseases should be destroyed by fire or they may be treated by exposure to formaldehyde gas. V. During each vacation the walls and woodwork should be wetted with a solution of bichloride of mercury (1:1000) and the windows should be kept open to admit great floods of sunlight and pure air. VI. Water coolers are unclean and unnecessary. They should not be allowed in school buildings. When practicable drinking fountains, consisting of a jet of water rising from the center of a piece of marble, requiring no cups, should be supplied. VII. Individual seats and desks should be provided in every school. VIII. Light and airy cloakrooms should always be provided, and hooks should be so separated that the garments of different pupils will not come into contact."

In times of an epidemic, every public place, theatre, ballroom, dining-hall, tavern, should be treated like a hospital. Where there is a large conflux of people, there are certainly many who carry the disease with them. The spitting nuisance should be persistently suppressed. Disinfection at regular intervals should be enforced by the authorities. Public vehicles must be so treated. That they should be disinfected after a case of smallpox has been carried in them is deemed quite natural. Hardly a livery stable-keeper would be found who would not be anxious to destroy the possibility of infection in any of

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his coaches. He must learn that diphtheria is, or may be, as dangerous a passenger as variola. And what is valid in the case of a hack is more so in that of railroad cars, whether emigrant or Pullman. They ought to be thoroughly disinfected in times of an epidemic, at regular intervals, for the highroads of travel have always been those of epidemic disease, and railroad officers and their families have often been the first victims of the imported scourge. Can this be accomplished? Will not railroad companies resist a plan of regular disinfection because of its expensiveness? Will there not be an outcry against this despotic violation of the rights of the citizen, and the independence of the moneybag? Certainly. But that also happened when municipal authorities began to compel parents to keep their children at home when there were contagious diseases in the family, and when a smallpox patient was arrested because of endangering the passengers in a public vehicle. In such cases, it is not society that tyrannizes the individual; it is the individual that endangers society. And society begins at last, even in America, to believe in the rights of the commonwealth, as compared with the exclusive rights of the democratic enemy of all the rest. The establishment of state and national boards of health proves that the narrow-minded theories of the strict constructionists have not only disappeared from our politics, but also from the conscience and intellect of society.

As stated above, every case of diphtheria demands isolation, during the winter on the upper floor of the dwelling; the windows should be open as much as possible, the furniture of the sick-room reduced to the least possible quantity, the room changed if possible every few days, and the bedding renewed frequently.

To what extent the infecting substance may cling to surroundings is best shown by the cases of diphtheria springing up in premises which had not seen diphtheria for a long time, but had not been interfered with; and best, perhaps, by a series of observations of autoinfection. When a diphtheritic patient has been in a room for some time, the room, bedding, curtains, and carpets are infected; the

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child is getting better, has a new attack, may again improve, and is again stricken down. I have seen some of these children die; but also others who improved immediately after having been removed from that room or that house. If in any way possible, a child with diphtheria ought to change its room and bed every few days.

The sick in crowded houses and quarters ought to be transferred to a special hospital, which ought not to be too large. The Willard Parker Hospital of New York, with its seventy beds for scarlatina and diphtheria, established through the combined efforts of the medical profession,⁵ is in that respect a praiseworthy example. The large amount of good it is doing would grow in geometrical progression if there were, as there ought to be in a large and ambitious metropolis, half a dozen institutions of the same class, not only for the poor, but for the well-to-do also, both towns-people and strangers. I have advocated, for dozens of years, the erection of a hospital for the accommodation of infectious diseases breaking out among the thousands of strangers staying in New York City at all times. As long as there is no place for them to go to, the cases of scarlatina, diphtheria, etc., are hidden in the boarding-houses and hotels, and are infecting the population at large. It is but a few years since a movement for the establishment of such an institution was begun; the hospital for scarlatina and diphtheria was finally established a year ago.

When diphtheria breaks out in a house, either private or tenement with no facility for isolation, and where there is no hospital in which to seek refuge, the well should be removed to a healthy place; in large cities, temporary homes ought to be provided for that purpose, to benefit the children of the poor. If the rich would but remember that their children will be affected through the many links between them and the poor (servants, messengers, schools, dresses brought home from the tailor or seamstress, or purchased in the stylish and expensive establishments which

⁵ See my presidential address before the Medical Society of the State of New York in the Transactions of 1882. [Vol. vii of the present edition of Dr. Jacobi's Works.]

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give out the work to tenement working-people, and toilers in sweat shops), their very egotism would compel them to do in their own interest what the humanitarian instinct may not suggest to them.

Prevention can accomplish a great deal for the individual. Diphtheria will not, as a rule, attack a healthy integument, either cutis or mucous membrane. The best preventive is, therefore, to keep the mucous membrane in a healthy condition, as I have tried to practise and teach these forty years. Catarrh of the mouth, pharynx, and nose must be treated in time. Many a chronic nasal catarrh, with big lymph bodies round the neck, requires sometimes for its cure but two or three daily warm salt-water irrigations (1:130) of the nose, and besides, if the children be large enough to do so, gargling. The addition of one per cent. of alum or less will often be found useful. This treatment, however, must be continued for many months, and may require years. Still, there is no hardship in it, and no excuse for its omission. A. Caillé's many eloquent appeals have done much to popularize it. The nasal spray of a solution of nitrate of silver, 1:500-1,000, when there are erosions, will accelerate the cure. Its application should be repeated every day or every few days for some time.

Krieger regarded the inhalation of dry (particularly furnace) air as the main predisposing cause of diphtheria on account of its deteriorating influence on epithelia. For a similar reason C. Brühl and E. Jahr demand that both heating apparatuses and ventilators should be so arranged and so ample as to equalize the humidity in winter and summer, especially in bedrooms and in schools. The children should be hardened and strengthened by the use of cold water. Not only houses but whole districts may be treated on the same principles. Favorable climatological changes have often been produced by irrigation, the establishment of new channels, of water-courses, and intelligent forestry. But it would cost millions to save lives wholesale; and all these millions are required to destroy lives wholesale in haphazard wars. In accordance with the above-mentioned principles authors emphasize the neces-

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sity of keeping the mucous membranes moist, and of preventing fissures and disintegration of the epithelia. In the last two or three decades the latter advice has been insisted upon by all those who had waked up to the necessity of prevention. Among others C. G. Rothe (1884) advised besides hygienic measures the frequent use by all the inmates of a stricken house of a gargle consisting of carbolic acid, alcohol, tincture of iodine, glycerin, and water; also the use by all children of a school of a solution of thymol (1:1,000) and cyanide of mercury for the very mildest affections. In connection with such advice one remark will always be in order, viz., that medicinal gargles and irrigations should not be as unpalatable and malodorous as they can possibly be made; children should not be made to look upon preventive measures as a punishment.

It was not always good-will and intelligence or knowledge that dictated either reasoning or recommendations. There is J. Renan for instance, who in his "Diphthérie," Paris, 1889, recommended the free use, among preventives, of sulphurous acid and turpentine. Altogether the literature of diphtheria is not free even from religious and political bias. According to Renan's monarchistic prejudices the inferiority of preventive practice in (republican) France is due to the changeability of its government. According to that theory Turkey and Russia would excel in preventive medicine, for—barring occasional assassinations—their governments are stable enough.

For its salutary effect on the mucous membrane of the mouth, chlorate of potassium or of sodium, which is still claimed by some to be a specific in diphtheria, or almost so, is counted by me among the preventive remedies. If it be anything more, it is an adjuvant only. It exhibits its best effects in the catarrhal and ulcerous condition of the oral cavity. In diphtheria it preserves the mucous membrane in a healthy condition or restores it to health. Thus it prevents the diphtheritic process from spreading.

Diphtheria is seldom observed on healthy or apparently healthy tissues. The pseudomembrane is mostly surrounded by a sore, hyperæmic, œdematous mucous membrane, to which it will then extend. Indeed, this hyperæmia pre-

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cedes the appearance of the diphtheritic exudation in almost every case. The exceptions to this rule are formed by those cases in which the virus may take root in the interstices, pointed out by Stoehr, between the normal tonsillar epithelia. Indeed, many cases of throat disease occurring during the prevalence of an epidemic of diphtheria are but cases of pharyngitis which develop only under favorable circumstances into diphtheria. These throat diseases are so very frequent during the reign of an epidemic that in my first paper on diphtheria, while reporting two hundred cases of genuine diphtheria, I mentioned besides one hundred and eighty-five of pharyngitis without a visible membrane.

These cases of pharyngitis, and those of stomatitis and pharyngitis which accompany the presence of membranes, are benefited by the local and general effect of potassic chlorate. When the surrounding parts are healthy or return to health, the pseudomembrane remains circumscribed. The generally benign character of purely tonsillar diphtheria, which is apt to run its full course in from four to six days, has in this manner contributed to secure to chlorate of potassium the undeserved reputation of being a remedy, *the* remedy, in diphtheria. The dose of the salt must not be larger, in twenty-four hours, than gr. xv. (1 gm.) for an infant a year old, not over gr. xx. or xxx. (1.5-2 gm.) for a child from three to five years. An adult should not take more than 3 iss. (6 gm.) daily. These amounts must not be given in a few large doses, but in frequent doses and at short intervals. A solution of 1 part in 60 may be given in doses of a teaspoonful every hour or half a teaspoonful every half-hour in the case of a baby one or two years old.

It is not too late yet to raise a warning voice against the use of larger doses. Simple truths in practical medicine do more than merely bear repetition—they require it. For though the cases of actual chlorate of potassium poisoning are no longer isolated, and ought to be generally known, fatal accidents are still occurring even in the practice of physicians. When I experimented on myself with half-ounce doses, forty years ago, the results

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were some gastric and intense renal irritation. The same were experienced by Fountain, of Davenport, Iowa, whose death from an ounce (30 gm.) of the salt has been impressively described in Alfred Stillé's "*Materia Medica*," from which I have quoted in my "*Treatise on Diphtheria*." His death from chlorate of potassium induced me to warn against large doses in my lectures as early as 1860. In my contribution to Gerhard's "*Handbuch der Kinderkrankheiten*," Vol. II., 1877, I spoke of a series of cases known to me personally. In a paper read before the Medical Society of the State of New York (*Medical Record*, March 15th, 1879) I treated of the subject monographically, and alluded to the dangers attending the promiscuous use of the drug, which had even then descended into the ranks of domestic remedies; and finally, in my "*Treatise on Diphtheria*," I collected all my cases and the few then recorded by others. Since that time numerous instances have been reported. Death probably occurs from methæmoglobinuria (as shown by Marchand, of Halle, in 1879), produced by the presence of the poison in the blood, and by consecutive nephritis.

The conscientious use of salt water as a preventive measure will prove more successful—when combined with the daily cold-water bath or ablution—than all the offensive smells and tastes which have been recommended.

Large tonsils should be resected and adenoid growths removed while there is no diphtheria; for during an epidemic every wound in the mouth is liable to become diphtheritic, and such operations ought to be postponed, if feasible. The scooping out of the tonsils, for whatever cause, I have given up since I became better acquainted with the use, under cocaine, of the galvanocautery. From one to four applications to each side are usually sufficient for every case of enlarged tonsils or chronic lacunar or deep-seated follicular amygdalitis ("tonsillitis"). It is advisable to cauterize but one side at a time, in order to avoid inconvenience in swallowing afterwards, and to burn the surface inward. Cauterization of the center of the tonsils may result in swelling, pain, and suppuration, unless the cautery is carried entirely to the surface; that

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means, the scurf must be on, or extend to, the surface, and not remain inside the tissue. Another precaution is to apply the burner cold, press it on, and then heat. The actual cautery is, however, not always required; a strong hook, without or with Gleitsmann's cutting edge, bent to a convenient angle, introduced into a follicular fistula, and torn through the superjacent tissue, will also cause cicatrization and a cure.

Nasal catarrh and proliferation of the mucous and sub-mucous tissues may require appropriate treatment with the electrocautery in many chronic cases, but the cases which demand it are less frequent than those in which the tonsils need correction.

The presence of lymph-node swellings round the neck should not be tolerated. They and the oral and nasal mucous membranes affect each other mutually. Most of them could be prevented if every eczema of the head and face, every stomatitis and rhinitis resulting from uncleanness, injury, or infection, were relieved at once. Pains-taking care of that kind would prevent many a case of diphtheria, glandular suppuration, deformity, or pulmonary consumption.

Prevention of diphtheria by immunizing doses of *anti-toxin* appears to be possible, but the effect does not last beyond a few weeks.

Slawyk's report, published in the *Deutsche Medicinische Wochenschrift*, No. 6, 1898, is very interesting. In Huebner's division of the Charité Hospital of Berlin relapses or endemic infections were quite common in spite of careful preventive measures until immunization by antitoxin was resorted to. The doses, of two hundred units contained in 8 c.c. each, were repeated every three weeks. In this way the place remained free of diphtheria. As a matter of experiment immunization was discontinued on October 1st, 1897. Three cases of diphtheria, one of which terminated fatally, occurred in the first part of November. The preventive injections were then made again, and during the following two and a half months, up to the time the report was published, no new case had been observed. Neither early age nor any complicating

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disease appeared to furnish a contraindication to the injections.

Similar results have been obtained in New York and elsewhere. The duration of the immunity so obtained is, however, limited. It has frequently been observed that a dose of from two to four hundred units of antitoxin, when given for immunizing purposes, appeared to be successful, until the child was taken with diphtheria thirty or forty days after the injection.

In connection with the preventive measures detailed above, I now add, though they be in part a repetition of what has been said, the regulations of the New York Health Department which have been in force for some time. They are clear, concise, and to the point.

"If possible, one attendant should take the entire care of the sick person, and no one else besides the physician should be allowed to enter the sick-room. The attendant should have no communication with the rest of the family. The members of the family should not receive or make visits during the illness.

"The discharges from the nose and mouth must be received on handkerchiefs or cloths, which should be at once immersed in a carbolic solution (made by dissolving six ounces of pure carbolic acid in one gallon of hot water, which may be diluted with an equal quantity of water). All handkerchiefs, cloths, towels, napkins, bed linen, personal clothing, night clothes, etc., that have come in contact in any way with the sick person, after use should be immediately immersed without removal from the room in the above solution. These should be soaked for two or three hours, and then boiled in water or soap-suds for one hour.

"In diphtheria and scarlet fever, great care should be taken in making applications to the throat or nose, that the discharges from them in the act of coughing are not thrown into the face or on the clothing of the person making the applications, as in this way the disease is likely to be caught.

"The hands of the attendant should always be thor-

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oroughly disinfected by washing in the carbolic solution, and then in soapsuds, after making applications to the throat or nose, and before eating.

"Surfaces of any kind soiled by the discharges should be immediately flooded with the carbolic solution.

"Plates, cups, glasses, knives, forks, spoons, etc., used by the sick person for eating and drinking must be kept for his especial use, and under no circumstances removed from the room or mixed with similar utensils used by others, but must be washed in the room in the carbolic solution and then in hot soapsuds. After use the soapsuds should be thrown into the water-closet and the vessel which contained it should be washed in the carbolic solution.

"The room occupied by the sick person should be thoroughly aired several times daily, and swept frequently, after scattering wet newspapers, sawdust, or tea leaves on the floor to prevent the dust from rising. After sweeping, the dust upon the woodwork and furniture should be removed with damp cloths. The sweepings should be burned, and the cloths soaked in the carbolic solution. In cold weather, the sick person should be protected from draughts of air by a sheet or blanket thrown over his head while the room is being aired.

"When the contagious nature of the disease is recognized within a short time after the beginning of the illness, after the approval of the Health Department inspector, it is advised that all articles of furniture not necessary for immediate use in the care of the sick person, especially upholstered furniture, carpets, and curtains, should be removed from the sick-room.

"When the patient has recovered from any one of these diseases the entire body should be bathed and the hair washed with hot soapsuds and the patient should be dressed in clean clothes (which have not been in the room during the sickness) and removed from the room. Then the Health Department should be immediately notified, and disinfectors will be sent to disinfect the room, bedding, clothing, etc., and under no conditions should it be again

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entered or occupied until it has been thoroughly disinfected. Nothing used in the room during the sickness should be removed until this has been done.

"The attendant, and any one who has assisted in caring for the sick person, should also take a bath, wash the hair, and put on clean clothes, before mingling with the family or other people after the recovery of the patient. The clothes worn in the sick-room should be left there, to be disinfected with the room and its contents by the Health Department."

Among the disinfectants employed to advantage in dwellings formalin has of late taken a high rank. A spray of a two-per-cent. solution has been found available. From 60 to 70 c.c. of dissolved concentrated formalin is believed to be sufficient for the space of one cubic meter (thirty cubic feet). One gram of formaldehyde evaporated from Schering's lamp or other apparatus renders the same service; or the substance may be allowed to evaporate gradually. Meanwhile the eyes should be protected by glasses, the nose by a mask, the hands by vaseline. Still, if Symansky be correct (*Zeitschrift für Hygiene*, etc., xxviii., 1898, p. 237), even formalin leaves much to be desired. He claims, while mentioning in its favor that it does not injure clothing and furniture, with the exception of changing red aniline dyes into purple, that its best effect is obtained at high temperatures and in dry atmospheres, and that it has but little penetration and destroys no spores, and for that reason yields no absolutely safe results.

LOCAL TREATMENT

The local remedies employed have been used for the purpose of either directly destroying the pseudomembrane, such as nitrate of silver, carbolic acid, the actual cautery; or to dissolve them, such as the alkaline carbonates, the chlorides, steam, papayotin; or to act as astringents, such as limewater and the chloride and subsulphate of iron; or to disinfect, such as the potassic chlorate, chloral hydrate, turpentine, carbolic acid, mercury, sulphur, bromine, iodine, iodoform, chlorine water, and peroxide of hydro-

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gen. The methods of application have been either local administration by the attendant, or washes and gargles, sprays, injections, or inhalations.

The local treatment of the mouth and throat has two indications; first, to maintain or restore a healthy condition of the mucous membrane of the cavities; second, to influence the diseased surface. Gargles in any shape will reach the oral cavity only. They never touch anything beyond the anterior pillars of the soft palate, and seldom more than a small part of the tonsil. The gargles with potassic chlorate, or with the sodic benzoate or biborate have only a preventive, not a curative, effect; still, they ought not to be neglected when the children are old enough to use them. Mild solutions of the above salts may also be introduced into the mouth of babies from time to time by means of a brush or a pipette. Local applications to the throat, even where they are possible, ought not to be made with powders. They are apt to nauseate and produce vomiting by their mere contact. Even powders for internal administration require careful mixing with water, for they are liable to irritate the throat; thus, the direct application of calomel, of the oxide of mercury, or of sulphur ought to be avoided. Applications of substances with bad taste or those that give pain must not be made, because the struggling and consecutive exhaustion of the patient will do more harm than the remedy will do good. That is so with a number of substances, particularly with the chloral hydrate, and even with the chloride of sodium which has been recommended, like a hundred other things, as a local application to the pseudomembrane of the tonsil.

In diphtheria the danger arises first from suffocation. That can be easily recognized, and the indications for the treatment by mechanical means—that is, intubation or tracheotomy—are readily found. These are the cases in which repeated fumigations with gr. vii.-xv. (0.5-1 gm.) of calomel, under a tent or in a small room, are used to advantage. Steam will also answer well under the same circumstances.

When the diphtheritic pseudomembrane is within reach,

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it should be either destroyed or disinfected. For that purpose one or two drops of a fifty-per-cent. solution of carbolic acid in glycerin may be applied once (not more than twice) a day, or of the tincture of iodine, or of a solution of 1 part of the bichloride of mercury in 100 or 500 parts of water, several times a day. It is in these cases that chlorine water has been injected through the surface into the upper layers of the tonsils. But we should never forget that only a small part of the pharynx is accessible to such treatment, and that it is only one class of patients that can be subjected to it. In order to be effective, the application must be thorough. None but adults or older children, and of them only a small number, will submit to opening their mouths and to the applications. It is that very class of patients who can be induced to gargle with some little, though very little, success. Smaller children will object, will defend themselves, will struggle. It takes many an anxious moment to force open the mouth; meanwhile, the patient is struggling, perspiring, screaming, and exhausting his strength. One may succeed in forcing open the jaws, then there begins the practice of making applications, of swabbing, of scratching off the pseudomembrane, of cauterizing, of burning. The struggling child will prevent the limitation of the application to the diseased surface. One cannot help injuring the neighboring epithelium, and thus the morbid process will spread. Instead of doing good, we have done harm; for, indeed, no local application can do so much good as the struggles of the frightened children do mischief. I have seen them die while defending themselves against the attempted violence, leaving doctor and nurse victorious and alive on the battlefield. It is incredible, but it is true, that more than one have recommended using the electrocautery or the thermocautery on the throat of the baby, after forcing the mouth open! It is almost incredible, for the offenders cannot have been ignorant of the fact that what they can reach with their instruments is but very little besides the tonsil, and they might have known that it is just the tonsils that are least apt to favor the admission of sepsis into the circulation.

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There is an easy way of using disinfectants on the throat and mouth, viz., to give medicines which are at the same time disinfectants, digestible, and easy to take; to give them in small doses but frequently; to see that when they have been given, no water or milk is taken immediately afterwards, so as not to wash them off from the mouth and throat. Such medicines are mild dilutions of the tincture of chloride of iron, or lime water, or solutions of boric acid, or of bichloride of mercury, or of benzoate of sodium, most of which will act both by their constitutional and their local effect.

Diphtheria is most dangerous when located in the nose and nasopharynx. The changes taking place in the nares may be an extensive catarrh, besides the diphtheritic deposits. The diphtheritic membranes are sometimes very thick, and contain a great deal of fibrin. Sometimes they are so thick as to clog the nares and prevent respiration. Underneath them copious absorption of toxins may take place. In most cases, however, the diphtheritic membranes are not so thick. Some of them macerate very readily, and the toxin is very speedily absorbed through the exceedingly copious lymph ducts, and sepsis is the result. In some cases of diphtheria, however, the membranes can hardly be seen. The discharge from the nose is liquid and acrid, contains small flakes and some blood. These are the cases in which the toxin is absorbed directly into the circulation. All of these forms may lead to necrosis and gangrene of the tissue, and produce a very peculiar, sweetish, nasty odor. Thus, the inhaled air is poisoned, and, being carried down into the lungs, acts as an additional peril. The most dangerous locality is the posterior nares, with their direct communications with the lymph bodies below the angle of the lower jaw. The pseudo-membranes, the lymph ducts, and lymph bodies, swarm with bacilli and toxin, with streptococci, with staphylococci, and lead to immense tumefaction between the ears and clavicles, to the formation of multiple small abscesses, to hemorrhages, to sepsis. All of these forms of nasal diphtheria require immediate, persistent, and efficient local treatment, for it is safe to say that every case of genuine

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or mixed nasal diphtheria has a tendency to terminate fatally.

The local treatment consists in cleansing and disinfecting. In most cases these two are identical, for if we simply succeed in washing out the macerating material, that proves sufficient. In order, however, to have that effect the washing and disinfecting must be done often—every half-hour, every hour, every two hours, day and night. In the bad cases, in which the nares are clogged with pseudomembrane, the cleansing and disinfecting are to be preceded by forcing a passage through the nares with a probe covered with wadding and dipped in carbolic acid. Particularly is this indication urgent when there is sopor, which owes its origin partly to the difficulty of respiration and carbonic-acid poisoning and partly to the septic condition. The methods of local treatment, besides the one just described, are the (not always successful) applications of ointments within the nose by means of the brush or wadded probe, or the use of the spray or syringe or irrigator, or the use of a spoon or a nasal cup or a feeding-cup, through which liquids are poured into the nares. The indispensability of these nasal administrations cannot be urged too positively. Park thinks that “when the strength is good and the nostrils and throat are full of discharge and membrane, it is well to insist on cleansing by irrigation; when, however, the child is much prostrated, and struggles against it, irrigation may have to be omitted” (“An American System of the Practice of Medicine,” i., p. 684). I believe, however, that in nasal diphtheria local treatment is the vital indication.

In making local applications it is important that the whole surface should be touched; therefore neither ointments nor instillations from a medicine-dropper are available in the average cases in which the whole nasopharynx is the seat of the affection; nor as a rule will the atomizer convey a sufficient amount of liquid into the cavities to be of much use. A spoon or a small feeding-cup, or better one of the nasal cups made for the purpose, the nozzle of which is narrow enough to enter the nose, will do fairly well, and will allow the introduction of liquids into the

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nares in small or large amounts, all of which will enter the throat, be either swallowed or flow out of the other nostril or out of the mouth. The irrigator (fountain syringe) is liable, by undue pressure, which cannot always be well measured, to injure the ear. It is true that this cannot take place very readily so long as the whole nasopharynx is covered with pseudomembrane, but this will not always remain, and then there is a possibility of the injection, when forced in, entering the middle ear. This will take place the more readily the younger the infant, because the pharyngeal orifice of the Eustachian tube is relatively larger and more funnel-like in the very young than in those of more advanced age. On the other hand, this configuration of the Eustachian tubes favors the escape of fluids from the middle ear; that is why otitis media in the very young is often painless. I generally prefer a small glass syringe with a conical nozzle of soft rubber. It will close up the nostril, the pressure can always be measured and modified (it should be very gentle), and it is effective. The injections must be made with the patient in the recumbent or semirecumbent position. On no condition, however, must a child with diphtheria be taken out of bed for the purpose of having the nares washed and disinfected. I know of many cases in which the patient died simply from being repeatedly taken up. The injection or irrigation is best made by a person who sits on the edge of the bed behind the patient, and raising his head gently supports it with his chest. A towel should quickly be thrown over the chest of the patient, and another attendant should secure the patient's hands. All preparations should be made out of sight. Slow irrigation should always be preferred to injection when there is some bleeding after every application.

The fluids to be used may be quite simple, but should always be warm. In many cases a solution of table salt in water (7:1,000), or boracic acid (2 or 4:100), or lime water will answer all purposes. The latter is particularly indicated when there is a thin, acrid, slightly fetid discharge. A more efficacious disinfectant than all of those mentioned is the bichloride of mercury, 1 part mixed with

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10 parts of chloride of sodium or chloride of ammonium in from 2,000 to 10,000 parts of water. It may be used freely.

If moderate quantities of a mild solution of bichloride of mercury be swallowed while being injected, no harm is done. Where there is a fetid odor, the nares ought to be deodorized frequently by carbolic acid or creolin or permanganate of potassium.

Carbolic acid may be used in solutions of from 1 to 10:1000 parts of water, but it should not be forgotten that there is some danger in swallowing it, because of the nephritis to which it may give rise. For the same purpose of deodorizing, creolin may be used in one-per-cent. solution. Loeffler's solution of alcohol 60, toluol 36, and tincture of iron sesquichloride 4 parts, does not act better than others, has a bad taste, is objected to very strongly, and gives rise to exhausting struggles. Permanganate of potassium in solution (1:250) may be applied once or twice a day to the fetid nares with a probe wrapped in absorbent cotton, or may be used for spraying, for injection, or for irrigation in a solution of 1:2,000-4,000 many times a day. Peroxide of hydrogen is a powerful disinfectant; some of its eulogizers condemn such preparations as are acid, others those which are not acid. Solutions which are not very dilute will coagulate the soluble albumin of the surface tissue with which they come in contact; form membranous deposits which are frequently mistaken for diphtheritic pseudomembranes; give rise, when the membranous artefacts will have been thrown off, to local sores, which may, and very often do, furnish a resting-place to new microbic invasions. This should be taken into consideration, and is true, though one of the manufacturers of this substance once tried to increase the vigor of the advertisement of his wares by coupling with it his conviction of my ignorance on the subject.

For the purpose of *dissolving membranes*, papayotin (not the proprietary medicine sold under a similar name) has been used in five-per-cent. solutions, as a spray, by injection, or as a direct application by means of a sponge or brush. Many years ago I employed it in greater con-

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centration to dissolve the diphtheritic membranes of the trachea below the tracheotomy tube. Its application in powder does not answer well. For the same purpose trypsin has been employed in five-per-cent. solutions, mixed with bicarbonate of sodium.

The *cervical lymphadenitis*, of which I have spoken as the result of nasal diphtheria, must be treated persistently and effectively. This treatment may be preventive and curative. The preventive treatment consists in the nasal injections described. The rapidity with which large swellings diminish when irrigations are made frequently and conscientiously is often surprising. When large tumefaction has taken place, tincture of iodine has been applied externally; in that way it is useless. Mercurial ointments and oleates have been applied; they also are useless, either as actual remedies or as a means of massage. An ointment of potassic iodide and *adeps lanæ hydrosus* (1:6-8) is more readily absorbed and less irritating. Ice externally is rational, but it is useless so long as the infection is not stopped. I have in a number of instances injected iodoform, in ether, into the swelled mass, but it is too painful and too efficacious, and does not pay for the agitation, anguish, and exhaustion of the unfortunate child. So, indeed, there is no remedy, besides the preventive measures, except in occasional long and deep incisions into the immense mass. We should not wait for fluctuation or even semi-fluctuation to become apparent. A great deal of the swelling is inside the fascia. Abscesses, when they form, are seldom large. The contents consist more of necrotic tissue, which ought to be laid open as soon as possible and disinfected. The incision must be a long one—in many cases from ear to clavicle. The disinfection of the wound may be obtained by applications of subnitrate of bismuth or tincture of iodine, and by iodoform or other antiseptic gauze. No carbolic acid should be used for disinfection, because of its tendency to give rise to hemorrhages. When a hemorrhage takes place, it will usually stop under pressure with antiseptic gauze; but sometimes, when a large blood-vessel has been eroded, it is very copious. In such cases the actual cautery, acu-

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pressure, or sometimes the ligature of blood-vessels has to be resorted to. Chloride of iron and subsulphate of iron must never be used on such necrotic surfaces. They give rise to a thick coagulated scab under which septic absorption is apt to take place.

Sanguinolent discharges from the nostrils may usually be arrested by the conscientious application of cleansing and disinfecting solutions (in most cases gentle irrigation works best). But the subsulphate or perchloride of iron should generally not be employed for the reason above given. The application of a solution of antipyrin (1:10, sometimes 1:3) by means of a swab or a spray will generally prove satisfactory in hemorrhages. In urgent cases a tampon saturated in a solution of antipyrin is required; its styptic property is enhanced by the addition of a small amount of tannic acid.

Moderate hemorrhages from the throat should be treated in a similar way, and by ice-bags properly applied. Unless they be parenchymatous their locality should be inquired into for the purpose of the localization of a styptic—antipyrin, or the actual cautery. If there be an erosion of a large vessel, such as the carotid artery in a case reported by me in the Transactions of the Association of American Physicians (1898), nothing short of the ligation of the vessel is appropriate. If it be the jugular vein which is ruptured, either ligation or compression should be resorted to.

Local treatment has lost its credit with some who believe that antitoxin alone should be relied on in all cases, and for all indications. That is a grave mistake, which will again be referred to below.

For the purpose of softening and macerating pseudomembranes steam has been extensively utilized. Its inhalation is useful in cases of catarrh of the mucous membranes, and in many inflammatory and diphtheritic affections. On mucous membranes it will increase the secretion and liquefy it, and thus aid in the throwing off of the pseudomembranes. Its action is the more pronounced the greater the amount of muciparous follicles under or alongside a cylindrical or fimbriated epithelium. Thus it is

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that tracheobronchial diphtheria and the non-bacillary forms of fibrinous bronchitis are greatly benefited by it. Children affected with them I have kept in small bath-rooms for days, turning on the hot water, and obliging the patient constantly to breathe the hot vapor. In several such cases I have seen recovery with that treatment. Atomized cold water will never yield the same result; nor have I seen the patented inhalers do much good. Still, where the surface epithelium is pavement rather than cylindrical, and where but few muciparous follicles are present, and when the pseudomembrane is rather immersed in, and firmly coherent with, the surface—for instance, on the tonsils—the steam treatment is less appropriate. On the contrary, moist heat is liable in such cases to favor the extension of the process by softening the hitherto healthy mucous membrane. Thus it takes all the tact of the practitioner to select the proper cases for the administration of steam, not to speak of the judgment which is required to determine to what extent the exclusion of air (oxygen) from the steam-moistened room, or tent is permissible.

Steam may be properly mixed with medicinal vapors. In the room of the patient water is kept constantly boiling over the fireplace, provided the steam is prevented from escaping directly into the chimney, on a stove (the modern “self-feeders” are insufficient for that purpose and are abominations for every reason), over an alcohol lamp, if we cannot do better, but not on gas, if possible to avoid it, because of the large amount of oxygen which it consumes. Every hour a tablespoonful of oil of turpentine, or of eucalyptus, and perhaps also a teaspoonful of carbolic acid, is poured on the water and evaporated with it. The air of the room is filled with steam and vapors, and thus the contact with the sore surfaces and the respiratory tract is obtained with absolute certainty.

The secretion of the mucous membranes is sometimes quite abundant under the influence of steam, but is still more, like that of the external integuments, increased by the introduction of water into the circulation. Therefore, drinking of large quantities of water or of water mixed

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with alcoholic stimulants should be encouraged. Over a thoroughly moistened mucous membrane the pseudomembrane is more easily made to float and to macerate.

To evolve large volumes of steam the slaking of lime has been resorted to. It is both an old and an effective procedure. Not only is the object in view accomplished by it, but it is the best means of bringing lime into contact with the morbid surface. In a room in which lime has been slaked, everything is covered with it. Thus this method of profiting by the local effect of lime is decidedly preferable to the almost nugatory effect of lime water sprayed into the throat.

In connection with these measures, taken for influencing the mucous secretions and exudations of the mucous membranes, I may here refer to some internal medication resorted to with the same object in view. It was to fulfil the same indication of softening the pseudomembrane, by increasing the secretion of the mucous membranes, that pilocarpine or jaborandi was highly recommended (Guttmann) as a panacea in all forms of diphtheria. There is no doubt that the secretion of the mucous membranes is vastly increased by the internal administration, or by repeated subcutaneous injections of the muriate or nitrate of pilocarpine, but the heart is enfeebled by its use. I have seen but few cases in which I could continue the treatment for a sufficient time. In many I had to stop it because after some days of persistent administration I feared for the safety of the patients. Therefore, as early as 1880, at the meeting in that year of the American Medical Association at Richmond, I felt obliged to warn against its indiscriminate use in diphtheria. Thus it has shared the fate of all the hundreds of remedies and methods which have been declared to be infallible and have been found wanting.

The diphtheritic *conjunctiva* should be irrigated frequently, every half-hour or every hour, with a mild antiseptic solution (boracic acid 1-4:100). These irrigations are quite often difficult to make because of the massive infiltration of the tissues. To counteract this and its pressure on the eyeball, I saw, thirty years ago, a deep hori-

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zontal incision made through the external angle. In some cases the pressure was relieved in spite of the extension of the diphtheria along the wound. Ice applications to the eye are always indicated, particularly at first. If bags will not be tolerated, cloths large enough to cover the eye should be placed on a lump of ice and applied fresh, without previous wringing, every two minutes. These ice applications should, however, be watched. They are liable to increase the anæmia caused by the infiltration of the tissues and give rise to necrosis. Such occurrences should be met by warm applications, which may increase the tendency to maceration. Abscesses in the lower part of the cornea should not be opened. Accompanying eczema or erythema of the cheeks should be treated with an iodoform-vaseline ointment (1:6-10), and cellulitis of the surrounding tissue of the cheek according to the common principles of antiseptic surgery.

Ammann treated six serious cases of diphtheria of the eye with repeated injections of antitoxin, which were not successful. It appears its effect is doubtful when the cornea is affected, and mainly, as it happened in his cases, when diphtheritic conjunctivitis and keratitis were complicated with the presence of cocci.

GENERAL TREATMENT

The *dietetic treatment* of a case of diphtheria, either simple and uncomplicated, or mixed, or septic, should be guided by circumstances and general principles. Solid food is rarely relished and generally refused, though there be but little pain in swallowing. A child may be permitted to go without food for the first day or longer. But the tendency to leucocytosis, hydræmia, and toxic exhaustion demands measures for the preservation and restoration of strength. Milk in different forms, with and without farinaceous admixtures, broths and beef juice, eggs in acceptable form, and alcoholic stimulants at an early time should be insisted upon. It should be superfluous to urge the necessity, while trying to remove the disease, of preserving the patient.

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The *medical treatment* of an average case of *pharyngeal diphtheria* can be made to combine the indications of both internal and local administration. For forty years I have employed the tincture of the chloride of iron. It is an astringent and antiseptic. Its contact with the diseased surface is as important as is its general effect; therefore it should be given frequently, in hourly or half-hourly doses, even every twenty or fifteen minutes. An infant of a year may take 3 or 4 c.c. (3 i.) a day, a child of three or five years 8 or 12 c.c. (3 ij. or iij.). It is mixed with water so as to make the dose half a teaspoonful or a teaspoonful; a drachm or two drachms (4 or 8 c.c.) with a small quantity of chlorate of potassium (see above), in four ounces (120 c.c.) allows half a teaspoonful every twenty minutes. No water must be drunk after the medicine. As a rule, it is well tolerated. There are some, however, who will not bear it well. Vomiting or diarrhœa is a contraindication to perseverance in its use, for nothing must be allowed to occur which reduces strength. A good adjuvant is glycerin, and better than syrups. From ten to fifteen per cent. of the mixture may consist of it. Now and then, but rarely, it is not at all tolerated. When diarrhœa sets in glycerin should be discontinued. Still, these cases are rare; indeed, the stomach bears glycerin very much better than the rectum.

I have seen so many bad cases recover under the administration of chloride of iron, when treated after the method detailed above, that I cannot rescind former expressions of my belief in its value. Still, I have often been so situated that I had to give it up in peculiar cases. They were those in which the main symptoms were of so intense a sepsis that the iron and other rational methods of treatment were not powerful enough to prevent the rapid progress of the disease. Children with nasopharyngeal diphtheria, large glandular swelling, feeble heart, and frequent pulse, thorough sepsis, and irritable stomach besides, those in whom large doses only of stimulants, general and cardiac, may possibly bring any relief, are better off without the iron. When the circumstances are such as to leave the choice between iron and alcohol,

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it is best to omit the iron and rely on alcoholic stimulants mostly. The quantities required are so large that the absorbent powers of the digestive tract are no longer sufficient for both.

Nor is iron sufficient or safe in those cases which are pre-eminently laryngeal. To rely on iron in membranous croup means both waste and danger.

When pharyngeal diphtheria has reached the *larynx* in its descent, or when bronchial diphtheria in its ascent has resulted in sudden laryngeal stenosis, the above anti-diphtheritic treatment avails but little. That neither general nor local depletion has any effect, except that of hopelessly reducing the patient's strength, has long been recognized; also that vesicatories add new diphtheritic exudations on the denuded surfaces to those already on the mucous membranes. Emetics are of no use unless a peculiar flapping sound betrays the presence of half-detached membrane in the air passage. In such a case they are apt to save life. Massage of the larynx has been recommended by Bela Weiss. I cannot say that, the few cases in which I advised the procedure were successful; it may be that the constant repetition of the advice to use mercurial or other ointments over the larynx is based on the observation of an occasional good effect of the friction ("massage") attending their employment. Locally, lactic acid, in more or less saturated solution, has been eulogized as a solvent of the membranes in the larynx, when often applied either by brush or spray. Most of the cases in which I have seen it used were not successful; but an untoward result in these cases is, unfortunately, not exceptional. I have seen, or believe I have seen, papayotin dissolve membrane when applied in a mixture of one part in two parts each of glycerin and water. Particularly would that occur in pharyngeal diphtheria slowly descending. Lime water is still used as a spray and has its admirers. Lime slaked in a small room, or under a tent, is decidedly more effective, for during that process a large quantity of lime is carried up and inhaled; at the same time the softening and solvent effect of the steam is obtained, but the latter is not always so benefi-

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cent as it appears. In many the application externally of cold water or ice-bags to the neck is vastly preferable. But in most cases of anæmic and highly nervous children the latter are not tolerated. Constant inhalations of turpentine or carbolic acid from a kettle of boiling water have impressed me as beneficial in a large number of cases. Inhalations, in a small room or under a tent, of calomel, which is sublimated in doses of gr. viij. or x. (0.5 gm.), every hour or at longer intervals, are certainly effective.

The patient remains in bed as much as possible, and may continue such expectorants as he perhaps took for previous catarrhal symptoms; he may also take diaphoretics and warm beverages; an occasional opiate to excite diaphoresis and to procure some rest. The continued use of chlorate of potassium, when the invasion of the larynx is complete, is rather superfluous. Antipyretics are out of the question unless there is a very high temperature depending on a complication (general diphtheria, pulmonary inflammations). Pilocarpine injures by debilitating the patient; the cases which are really benefited by it are exceedingly rare. Mercurials have resulted in more actual recoveries than has any other internal treatment. The cyanide and iodide have been recommended. For nearly twenty years I have employed the bichloride in doses of 1 mgm. (gr. $\frac{1}{60}$) or more once every hour. The smallest babies take one-fourth or one-third of a grain daily for days in succession. Almost never will a stomatitis follow, and no gastric or intestinal irritation, provided the dilution be in the proportion of at least 1:8000. An occasional slight diarrhoea may require the addition of a few drops of camphorated tincture of opium. I can repeat a former statement, that never before the antitoxin period (see below) have I seen cases of croup getting well in such numbers, either without or with tracheotomy or intubation, as when under mercurial treatment. I would not be understood, however, to limit the use of mercury to laryngeal diphtheria; it has equal effects in that of the pharynx, and mostly in the streptococcic and in the mixed forms of diphtheria. In connection with this statement I wish to emphasize again the necessity of not relying

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on a single method of treatment in a disease so dangerous and whimsical as diphtheria. The self-complacent nihilism which relies exclusively on pathological research and laboratory methods has more than once impeded the medical and social and humanitarian position of clinical medicine. It is a pleasure, therefore, to quote an author who has won laurels in bacteriology: "The giving internally of the tincture of the chloride of iron or of the bichloride of mercury in small frequent doses has considerable local effect upon the mucous membranes of the throat and pharynx" (W. H. Park).

When, in laryngeal diphtheria, internal treatment proves unsuccessful, intubation or tracheotomy should be resorted to. A small, frequent, and intermittent pulse, aphonia, cyanosis, and marked retraction, with every inspiration, of the supraclavicular fossæ and the epigastrium, are most urgent indications for the operative procedure. They should not be allowed to last. I shall not here be tempted to discuss the criminality of allowing a child to suffocate without resorting to mechanical relief, or to compare the two operations with each other. I can only say that for years I have not seen a case in which intubation would not take the place of tracheotomy, and have, therefore, not performed the latter. Intubation takes the place of tracheotomy in most cases; in none does it make it impossible when required in the opinion of the operator. The latter operation may be preferred or become necessary for the purpose of getting at the trachea and bronchi for the mechanical removal of membrane and other local treatment, rare though the cases be in which such procedures are attended with success. It is probable that the many secondary tracheotomies which are still performed in Europe when intubation is alleged to be insufficient will not be considered requisite in the future. Nor is it probable that Bokai's method of using intubation as an adjuvant to tracheotomy will be followed long even by that distinguished clinician himself. Since 1891 his practice has been first to perform intubation and then tracheotomy, removing the tube just before he makes his incision into the trachea.

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In the vast majority of cases of pseudomembranous laryngitis the Klebs-Löffler bacillus is found; and all of them are, therefore, fit subjects for the use of the diphtheria antitoxin. Since its introduction both general and local (laryngeal) diphtheria have been greatly benefited. At its Washington meeting in May, 1897, the American Pediatric Society received the "Report of its committee on the collective investigation of the antitoxin treatment of laryngeal diphtheria in private practice." Its salient points are as follows: The number of cases reported during the eleven months ending April 1st, 1897, was 1704—mortality, 21.12 per cent. The cases occurred in the practice of 422 physicians in the United States and Canada. Operations employed: Intubation in 637 cases, mortality 26 per cent.; tracheotomy in 20 cases, mortality 45 per cent.; intubation and tracheotomy in 11 cases, mortality 63.63 per cent. Number of States represented, 22, besides the District of Columbia and Canada. Non-operative cases, 1036, mortality 17.18 per cent.; operated cases, 668, mortality 27.24 per cent.

Two facts may be recalled in connection with these statements: First, that before the use of antitoxin 90 per cent. of cases of laryngeal diphtheria required operation; under the antitoxin, however, 39.21 per cent. Second, that the percentage figures have been reversed: formerly 27 per cent. represented the recoveries; now, under antitoxin, this figure represents the mortality. The committee expects still better results when antitoxin will be administered earlier and in larger doses, and recommends that all patients with laryngeal diphtheria, being two years or over, should receive as follows: Two thousand units at the earliest possible moment, two thousand units after twelve or eighteen hours, unless there be an improvement, and the same dose twenty-four hours after the second dose, if there be still no improvement. Patients under two years should receive one thousand or fifteen hundred units.

Dr. Dillon Brown's personal experience being unusually large and carefully recorded, I add without comment the following figures reported by him. He divided his intubation cases into three classes: Previous to November,

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1890; from November, 1890, to September, 1894 (calomel sublimation period); from September, 1894, to April 1st, 1897 (antitoxin period). Of 442 cases of intubation without calomel sublimations and without antitoxin, 27.3 per cent. recovered. Of 295 cases of intubation with calomel sublimations, 41.6 per cent.; of 69 cases of intubation with antitoxin, 67.8 per cent. recovered. Without sublimations, 10.1 per cent.; with sublimations, 13.2 per cent.; with antitoxin, 23.3 per cent. recovered. During the first year with antitoxin, there were recoveries after operation in 38.4; during the second year in 62.9; during the third in 94.7 per cent. The apparently bad results during the first year were probably due to two causes: inferior antitoxic serums and insufficient doses.

Caillé sums up his personal experience as follows: "Tracheotomy and intubation cases, before antitoxin, 280 cases, 30 per cent. recovered; 17 intubation cases, with antitoxin, 3 deaths. Over one-half of all laryngeal cases treated with antitoxin recovered without operation. In every case of acute progressive stenosis 1500 to 2000 units of diphtheria antitoxin should be administered at once, and the dose may be repeated in twelve to twenty-four hours, and so on until relief is manifest."

In Baginsky's hospital service there were 1258 cases of diphtheria in the years 1890-94; 418 tracheotomies and 135 intubations were performed, with a total mortality in these 533 operations of 62 per cent. In the 418 tracheotomies the mortality was 64.4 per cent.; among these were 77 which were performed after intubation; these 77 had a mortality of 69 per cent.; 58 intubations without secondary tracheotomy had a mortality of 41.8 per cent. This condition of things changed with the inauguration of antitoxin treatment. No case of laryngeal stenosis developed in those in whom the remedy was injected before the larynx became affected. Thus it was that in 525 cases there were but 53 tracheotomies and 54 intubations, the former with 34 deaths, the latter with 2. It became necessary to perform tracheotomy after a previous intubation in 12 cases, of which 9 ended in death. The speedier disintegration of the membranes and the almost general

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discontinuance of their growth after the injection of antitoxin are the reasons why Baginsky has since preferred intubation to tracheotomy.

At that early time in which his results were published, Heubner performed 33 operations in 181 cases—viz., 23 tracheotomies with 52 per cent., 10 intubations with 80 per cent. recoveries—a remarkable improvement over the figures of the ante-antitoxin period.

At the International Congress of Moscow Monti made the statement that in his service cases of laryngeal stenosis were apt to get well under the sole influence of antitoxin, that an operation was resorted to only when that treatment proved unsuccessful (after some days), and even then was likely to be successful. Without antitoxin, in former times, his intubations would yield a mortality of from 25 to 40 per cent., now while antitoxin was employed, 12 per cent. Only in the "mixed" infections the mortality rose to 33 per cent.

It is useless to quote any more experiences in regard to the efficacy of antitoxin in diphtheritic stenosis of the larynx. In many cases it renders operations unnecessary; in those operated upon the prognosis is improved. Still many die; of those following "mixed" infections many die. If there be those who shoulder the responsibility of relying on a sole remedy, which frequently heals and frequently fails, to the exclusion of every other helpful medication or contrivance, they are as short-sighted as those who still refuse altogether to acknowledge the great efficacy of antitoxin in diphtheria. The fanaticism of the one should not be permitted to justify that of the other. The satisfaction at having a powerful remedy like antitoxin should not engender the nihilism which begins after the subcutaneous injection of serum. This cannot be said too often, particularly in reference to "mixed" infections. It is only the bacillus part of the malady which can be counteracted by antitoxin. The mixed infections at least, with their virulence and danger, should not be left to die without medication beyond injection and "expectant" neglect.

Heart failure is usually developed gradually. It is

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foreshadowed by an increasing frequency and weakness of both heart beats and pulse, by an occasional intermission, by unequal frequency of the beats in a given period (say of ten seconds), or by the equalization of the interval between systole and diastole, and diastole and systole. This latter condition, which is normal in the embryo and foetus, is always an ominous symptom; so is the too close proximity of the second sound (so as to become almost inaudible) to the first.

Heart failure is due, besides the influences common to every disease and every fever, to tissue changes in the myocardium, in its nerves, in the endocardium, and to the gradual formation of blood clots. These changes may be due to the malnutrition of the tissues resulting from every septic condition of the blood, or to specific alterations due to the diphtheritic process. Failure may come on after having given warning, or it may be on us without any. Thus every case of diphtheria ought to make us anxious and afraid. Indeed, there is no safety and no positively favorable prognosis until the patient is quite recovered, and even advanced beyond the period in which paralysis may develop.

Whatever enfeebles must be avoided; absolute rest must be enjoined. The patients must be in bed, without excitement of any kind; they must take their medicines—which ought to be as palatable as possible—and their liquid food, and evacuate their bowels in a recumbent or semirecumbent position; crying and worrying must be prevented; the room must be kept airy and rather dark, so as to encourage sleep if the patients be restless; and restless they are, unless they be under the influence of sepsis, and thereby subject to fatal drowsiness and sopor. In no disease, except perhaps in pneumonia, have I seen more fatal results from exertion on the part of the sick, or from anything more fatiguing than a sudden change of posture. Unless absolute rest be enforced, neither physicians nor nurses have done their duty. The latter must avoid all the dangers attending the administration of medicines, injections, sprays, and washes. Preparations for the same must be made out of sight, every application should be

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made quickly and gently. On no account must a patient be taken out of bed for any of these purposes. I know of children dying between the knees of nurses who called themselves trained and had a diploma.

The use of pharmaceutical preparations, such as digitalis, strophanthus, sparteine, caffeine, besides camphor, alcohol, and musk, should not be postponed until feebleness and collapse have set in. These are at least possible, even probable, and it is certain that a cardiac stimulant will do no harm. It is advisable to use it at an early date, particularly in those cases in which perhaps antipyrin or antifebrin (the indications for which are certainly rare, as excessive temperatures are very exceptional) is given. Besides, it is not enough that the patients should merely escape death; they ought to get up, *cito, tuto, et jucunde*, with little loss and speedy recuperation; a few grains of digitalis or their equivalent—preferably a good fluid extract—may or should be given, in a pleasant and digestible form, daily. When a speedy effect is required, one or two doses of two to four minims each are not too large, and must be followed up by smaller ones. When it is justly feared lest the effect of digitalis be too slow, I give, with or without it, strophanthus, in doses of from one to six drops of the tincture, or sulphate of sparteine. Of the latter an infant a year old should take gr. $\frac{1}{10}$ or $\frac{1}{4}$ (6-15 mgm.) four times a day as a matter of precaution, and every hour or two hours in an emergency.

Of the same importance are alcoholic stimulants. The advice to wait for positive symptoms of heart failure and collapse before employing the life-saving apparatus is bad. There are cases which will get well without treatment, but we do not know beforehand which they will be. No alleged mild case is safe until recovery has taken place. When heart failure has once set in—and it frequently occurs in apparently mild cases—our efforts are too often in vain. Thus alcoholic stimulants ought to be given early and often, and in large quantities, thoroughly diluted. There is no such thing as danger from them or intoxication in septic diseases—100 c.c. (3 iii.) daily may suffice, but I have often seen 300 c.c. (3 ix.) or more

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daily of brandy or whiskey save children who had been doing badly with 100 c.c. ($\frac{3}{4}$ iii.).

Caffeine, or, in its stead, coffee, is an excellent cardiac tonic, except in those cases in which the brain is suffering from active congestion. For subcutaneous injections the salicylate (or benzoate) of caffeine and sodium, which readily dissolves in two parts of water, is invaluable for emergencies, in occasional doses of from gr. i-v. (6 to 30 cgm.) in from m ij.-x. of water. From gr. v.-xx (0.3-1.25) of camphor may be given daily, as camphor water, or in a mucilaginous emulsion, which is easily taken. It does not so disturb the stomach as carbonate of ammonium is apt to do. For rapid effect it may be administered hypodermically, in four to five parts of sweet almond oil, which is milder and more convenient than ether. Strychnine may be added regularly from the beginning of danger, and mainly in cases with little increase of temperature. Its effect is more than momentarily stimulating. A child of three years will take gr. $\frac{1}{120}$ (0.5 mgm.) three times a day, and much more in an urgent case, and then subcutaneously. But the very best internal stimulant in urgent cases is Siberian musk. I prefer to give it from a bottle, in which it is simply shaken up with a thin mucilage. In urgent cases it ought to be administered in sufficient doses and at short intervals. When ten or fifteen grains given to a child one or two years old within three or four hours will not restore the heart's action to a more satisfactory standard, the prognosis is very bad.

Nephritis, parenchymatous, interstitial, and glomerular, and the varieties of *pneumonia* are frequent complications or consequences of diphtheria. The treatment of either of them requires no particular discussion in this place. Nor does *œdema of the glottis* yield indications differing from those of the same affection occurring from other causes.

Diphtheria of the *skin* and of the *sexual organs* requires disinfectant ointments. I have mostly relied on iodoform one part, in from eight to twelve parts of fat.

Diphtheritic *paralysis*, though of manifold anatomical and histological origin, yields in all cases a certain num-

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ber of identical therapeutical indications. These are the sustaining of the strength of the heart by digitalis and other cardiac tonics. This is an indication on which I cannot dwell too much. Many of the acute, and most of the chronic, diseases of all ages do very much better by adding to other medication a regular dose of a cardiac tonic. While it is a good practice to follow the golden rule to prescribe simply, and if possible a single remedy only, it is a better one to prescribe efficiently.

Besides, there are some more indications: mild preparations of iron, provided the digestive organs are not interfered with; strychnine, or other preparations of nuxvomica, at all events; in ordinary cases a child of three years will take gr. $\frac{1}{80}$ three or four times a day (together 0.002 gm.). Local friction, massage of the throat, of the extremities, and trunk, dry or with hot water, or oil, or water and alcohol; and the use of both the interrupted and continuous currents, according to the known rules and the locality of the suffering parts, find their ready indications. The paralysis of the respiratory muscles is quite dangerous; the apnoea resulting from it may prove fatal in a short time. In such cases the electric current used for short periods, but very frequently, and hypodermic injections of sulphate of strychnine in more than text-book doses, and frequently repeated, will render good service. I remember a case in which these, with the occasional use of an interrupted current, and occasional artificial respiration by Sylvester's method, persevered in for the better part of three days, proved effective. In a few cases of diphtheritic paralysis the use of antitoxin appeared to score a success. Other forms of paralysis (hemiplegia, ataxia) demand a treatment like the above, modified by their peculiar circumstances or symptoms.

Orrhotherapy.—The use of diphtheria antitoxin has been discussed several times on previous pages, mainly as regards its effect as an immunizing agent and its action in laryngeal diphtheria. It has passed its experimental stage as safely as if it had been employed these fifty years, and has created a literature of its own on which bacteriologists, chemists, medical and surgical clinicians, practical

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men and theorists, friends and enemies have been at work. No matter what the nature of its action may be, whether when injected under the skin of a diphtheria patient it supplements the antidote created by the toxin of diphtheria in the blood or the cells of the patient, or whether it aids the antitoxin into which the toxin is believed by some to be changed (Buchner, Smirnow, Metchnikoff) or which is the product of reaction (Behring, Ehrlich⁶), this action can no longer be doubted. Discussions on that point are fruitless. When the injection is to be made, the syringe should be sterilized each time, for no poison is entirely safe. A carbolic-acid solution of five per cent., and absolute alcohol will suffice for that purpose. The injection should be made into a loose and copious subcutaneous tissue, not into the skin, and not into muscles. The abdomen is more sensitive than the lumbar region and the thigh, and the subscapular or intrascapular region. The latter should not be selected unless the subcutaneous tissue is quite abundant. According to the severity of the case six hundred, one thousand, fifteen hundred or two thousand "units" should be injected. The dose should be repeated unless the symptoms—both constitutional and local—be improved within twelve or twenty-four hours. Sixty-five hundred units were successfully used in a bad case of noma of the vulva, in which diphtheria and putrefactive bacteria were found by Petrushky (*Deutsche medicinische Wochenschrift*, 1898). The puncture should be covered with an antiseptic gauze, or with iodoform collodion.

A "unit" is equivalent to 1 c.c. of what is called "normal serum." Normal serum is the blood serum of an immunized animal which was made so efficacious that 0.1 c.c. antagonizes ten times the minimum of diphtheria poison fatal to a guinea-pig weighing 300 gm. (about 10 ounces).

The universal demand is for early injection. There is unanimity in the experience that the prognosis is impaired by procrastination. The latest report from Vienna is only

⁶ Ehrlich thinks the antitoxin is the result of functional overexertion of the cell protoplasm which has been irritated by the circulating toxin, and compares this process with the hypertrophy of overexerted organs.

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a repetition of what has been known these four years. When antitoxin was injected on the first and second day, only 6.7 per cent. of all the cases died, on the third 19, on the fourth 23, on the fifth 31, on the sixth 33.3 per cent.

This fact has become so fixed in the minds of many practitioners who believe themselves responsible for the welfare of their patients, that in doubtful cases in which the diagnosis of "diphtheria" or "pseudodiphtheria" has not been made on account of time, and in view of the innocuousness of antitoxin when injected unnecessarily, and believing that whatever discomforts there may arise after the injection do not compare with the danger of the disease when not combated in time, they "inject the antitoxin and settle the question of diagnosis afterwards" (Charles G. Jennings in *Medical Age*, February 25th, 1898). In general that practice is to be recommended in bad cases and bad seasons, for the bacteriological diagnosis can be completed before another injection is required, if at all.

All forms of diphtheria are liable to be benefited by antitoxin, from the simplest to the septic, from the uncomplicated to the mixed, the latter less than the former. It is this mixed form in which I look upon the neglect of other treatment, both local and general, as simply criminal. The statistics both of hospitals and of private practice have grown immensely, and are daily growing; they are the staple article of our journal literature. I would therefore refer the reader to what I quoted in my "Therapeutics of Infancy and Childhood," and will conclude with a few of those data which are quite recent.

Of the report of the diphtheria committee of the Clinical Society of London *The Lancet* (June 4th, 1898) publishes what follows:

"For the purpose of the inquiry 832 reports of cases were collected, but upon examination 199 of them had to be rejected, either because the committee were not satisfied as to the evidence of diphtheria or because the amount of antitoxin administered was not stated in normal units,

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leaving 633 available for further analysis. Of the cases which presented symptoms more or less severe of laryngeal affection nearly one-half escaped the operation of tracheotomy, a very much larger proportion than is usually the case in laryngeal diphtheria treated in other ways. The tracheotomies performed may be divided into two groups: (a) Tracheotomy within twenty-four hours of the first injection, and (b) tracheotomy at a later period. Only 2 out of the 75 belong to group (b). The committee drew especial attention to these facts, and also to the results of the operation of tracheotomy, in which the mortality amounted to 36 per cent., as opposed to 71.6 per cent. in the control series compiled from the records of the general hospitals before the introduction of antitoxin. The mortality fell as age increased, but it was in the first five years of life that the lessened mortality in the antitoxin series was most marked. It was to the lesser frequency with which membrane extended to the larynx and trachea in cases treated by antitoxin and to the effect of the antitoxin on them when membrane was present that the lessened mortality in the antitoxin series was mainly due. The total mortality in the 633 cases amounted to 124, or 19.5 per cent., as opposed to 29.6 per cent. in the non-antitoxin control series. Not only was the mortality in the antitoxin series much less than in the other, but the duration of life in the fatal cases was longer, a fact which has considerable bearing on the frequency with which paralytic symptoms occurred. The closest investigation failed to discover any connection between the occurrence of paralysis and the amount of antitoxin injected, nor did the period of the disease at which it was first used appear to exert any influence on the occurrence of paralytic symptoms. Some form or other of rash followed the injection of antitoxin serum in very nearly a third of the cases. The rashes could be divided into two main types: those which were of an erythematous and those of an urticarial character; the former largely predominated. In no instance did the presence of a rash appear to have any bearing on the ultimate result of the case. Joint pains which were not met with in the non-antitoxin series and

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were apparently due to the antitoxic serum were observed in a small number of cases. The percentage of deaths with suppression of urine was found to be practically the same in the antitoxin and the non-antitoxin series. The general result of the inquiry showed that in the cases treated with antitoxin not only was the mortality notably lessened, but the duration of life in fatal cases was also prolonged. The injection of antitoxin may produce rashes, joint pains, and fever; with these exceptions no prejudicial action has been observed in the series of cases investigated to follow even in cases in which a very large amount of antitoxin serum has been used."

According to Buchwald (*Münchener medicinische Wochenschrift*, 1898, No. 14) of 563 patients treated without antitoxin, 57.72 per cent. died; of 311 treated with it, 28.93 per cent. died. Tracheotomies were required in 57 per cent. in the ante-serum period, in 30.86 per cent. during the serum time. Albuminuria was observed in 36.65 per cent. of all the injected cases, paralysis in 93 cases, exanthems in 74, pain in joints, without swelling, however, in 2, otorrhœa in 10, bronchopneumonia in 36 cases. Most of the latter were fatal. Besides antitoxin, good nutrition, stimulants, and irrigation of the nose and mouth were employed.

Axel Johannessen communicated to the Moscow Congress a report covering 1131 cases of diphtheria observed during 1890 by 71 Norway physicians. Those cases were treated with antitoxin; there were 73 deaths (6.5 per cent.); this percentage is reducible to 5.3 per cent. by deducting the cases that came under treatment while moribund. From 1867 to 1893, before the antitoxin period, the mortality was 23.5 per cent.

Escherich had in Prague a mortality of 9 per cent., compared with 36 per cent. of former times.

John E. Walsh (*New York Medical Journal*, June 18th, 1898) publishes the following figures. In 1895-96 there were treated in the District of Columbia:

Cases with antitoxin, 174; died, 23=13.2 per cent.
Cases without antitoxin, 152; " 53=34.9 "

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In 1896-97 there were:

Cases with antitoxin,.....285; died, 21= 7.3 per cent.

Cases without antitoxin, 335; " 89=26.6 "

Of the 285 antitoxin cases there were 238 below twelve years, with a mortality of 8.9 per cent.; of the 335 non-antitoxin cases there were 256 below twelve years, with a mortality of 33 per cent. Of 86 over twelve years treated with antitoxin none died; of 113 of the same age treated without antitoxin, 8 died. In the last seven months preceding the publication 422 cases were treated: 211 with antitoxin and a mortality of 8, or 3.8 per cent.; 190 without antitoxin and a mortality of 65, or 34.2 per cent., as in the pre-antitoxin period. The treatment employed in 21 cases was unknown to the writer.

Among the very latest statistics are those of Krönlein (Zürich), who reported to the Twenty-seventh Congress of German Surgeons (April, 1898) on 1773 cases of diphtheria observed in the clinical hospitals of the university during the years 1881-97. A recapitulation of the results is presented in the following table:

	PRE-ANTITOXIN PERIOD			ANTITOXIN PERIOD
	"Old croup room." 1881-1890	New diphtheria house 1889-1894	Total 1881-1894	New diphtheria house 1894-1897
Total	485	851	1,336	437
Deaths	230	304	534	55
Mortality	47.4%	35.7%	39.9%	12.5%
Operations	354	308	662	17
Deaths	211	227	438	36
Mortality	59.6%	73.7%	66.1%	35.6%
Cases not operated	131	543	674	336
Deaths	19	77	96	19
Mortality	14.5%	14.1%	14.2%	5.6%

In all the 437 cases in the antitoxin period the Klebs-Löffler bacillus was demonstrated. Krönlein's statistics

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prove the following facts: While the morbidity of the whole district (city and country) remained unaltered in the antitoxin period, the mortality decreased considerably—mainly in the surgical clinic, in operated (tracheotomy or intubation) or non-operated cases, and principally in the first years of life. While previous to the institution of antitoxin treatment one-half of all the cases had to be operated upon, this percentage has fallen to 23.1 per cent. since that time.

After the injection of antitoxin improvement set in speedily; the temperature diminished; the deposits on, and the membranes in, the throat and air passages soon loosened, and the diphtheritic secretion of the nose became speedily less; the lymphadenitis of the neck diminished; the diphtheria process did not descend into the air passages; mild laryngostenosis did not increase; there was no diphtheric infection of the tracheotomy wound, which was observed in one-third of all the cases of former times; and the tube could be removed as early as the third, fourth, or fifth day after tracheotomy.

During the same period albuminuria was observed in 36.6 per cent. of all cases of diphtheria, pronounced nephritis in 4.6 per cent., and postdiphtheritic paralysis in 12.5 per cent. Exanthems of the most various forms, with mild general symptoms only, were met with in 8 per cent.; they were attributed to the serum. None was found after small injections made for the purpose of immunizing healthy persons.

To gainsay, with such statistics at hand, the superiority of antitoxin to any other single remedy known to us for diphtheria is a foolhardy undertaking. But there are some drawbacks met in its employment which are acknowledged by all, and exaggerated by some. I refer to disagreeable symptoms with which the administration of antitoxin is charged, and which are said to take place in the blood, on the skin, in the joints, in the respiratory, circulatory, urinary, digestive, and nervous systems. Even sudden death has been claimed as one of the results of antitoxin injections.

Dr. James Ewing studied the effects of antitoxin on the

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number and nature of *leucocytes* (*New York Medical Journal*, August 17th, 1895). While leucocytosis begins a few hours after the invasion of diphtheria, and increases mainly as regards myelocytes (uninuclear and neutrophilic granules which are never found in the lymph nodes) up to the climax of the disease, and steadily declines during convalescence—remaining high only in most of the bad and fatal cases—antitoxin causes, according to Ewing, a reduction of the number of leucocytes within thirty minutes after the injection. This reduction affects mainly the uninuclear leucocytes, while the proportion of well-stained multinuclear cells is increased. In favorable cases the leucocytosis never again reaches its original height after the injection; in severe and very bad cases it is followed in a few hours by more leucocytosis and fever. In very bad cases the immediate result may be either rapid increase or decrease of leucocytes, and death. The multinuclear leucocytes found in the blood in favorable cases after treatment with antitoxin show an increased affinity for gentian violet. This change may be observed within twelve hours after the injection, and its non-occurrence is a very unfavorable prognostic sign.

John S. Billings, Jr., found after the employment of antitoxin some little diminution in the number of blood cells. In six cases so treated he met with a steady rise, and the decrease of hæmoglobin was less marked than in cases of uninfluenced diphtheria.

Urticaria, sometimes with increased temperature, simple or complicated with *erythema* (simple, or multiform, or exudative with or without extravasation) is observed at different times, very soon or a few days after the injection round the puncture, or after one or more weeks in different parts of the body. Now and then the efflorescence requires some predisposition, for it has been noticed in one child of a family while the rest remained free. Horse serum containing no antitoxin is known to have caused the same eruption; this effect appears to be more marked in the serum of one horse than in that of another. It is similar to what has been observed after transfusion of the blood of heterogenous animals. The small amount of carbolic

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acid contained in the antitoxin should not be held responsible for the eruption; nor can the local irritation be charged with causing eruptions which take a week or weeks to develop. Altogether this urticaria behaves like the vasomotor or neuropathic cutaneous irritations observed in predisposed persons after the use of oysters, crabs, or strawberries.

Herpes (nasal, labial, aural) has been noticed in a few instances, notably by Baginsky, and by Mya, who observed at the same time a "critical" fall of the temperature of the body.

Other forms of eruptions, macular, papular, and erythematous, also petechiæ with or without larger extravasations, have been recorded. Desquamation is observed in proportion to the degree of dermatitis. Some observers speak of many cases, others of few, others (Rumpf) never saw any eruption.

W. T. Coues reports fifty cases of antitoxin injections for the purpose of immunization. A child of five years received five hundred units, a baby of one day fifty, those under six months three hundred, under a year four hundred. The older children were not affected in the least; the infants were restless and cried long after the injection. The temperature of three infants reached 101° F. five hours after the injection; the next morning it was normal. On the morning following the injections the younger children had slight coughs, which passed away in two or three days. Urticaria occurred in 14 cases out of the 50 injected; a punctated erythema in 2; in 1 there were soreness and pain in the right knee-joint, which passed off in two days (*Boston Medical and Surgical Journal*, July 14th, 1898).

Abscesses, occasionally with lymphangitis, have been observed by Monti, Variot, and others. When they occurred, fault was found with the serum which was not considered germ-free, or with the skin which was charged with not having been aseptic, or with the undue thickness of the needle and subsequent infection of the wound, or with the perforation of too many layers of tissue down into the muscles, or with the condition of the syringe, which it is

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difficult, no matter whether the piston is leather or asbestos, to render absolutely safe. In a few instances symptoms were observed which were attributed to the entrance of air into a small vein.

Arthropathies were noticed with or without exanthems. Swelling and pain of a knee or an ankle-joint were noticed a few times, together with urticaria in the second week after an injection. These lasted a day or a week or more. They are not frequent, for there are observers who have never seen them in any of a large number of cases. It should not be forgotten that they are symptoms which occasionally occur in diphtheria not treated with antitoxin.

Lymph bodies now and then swell after an antitoxin injection, but only in connection with an eruption or an arthropathy.

Antitoxin has been charged with causing *pneumonia*. The latter is so frequent a complication of diphtheria in all its stages that the attempt to substantiate the charge seems hazardous. If antitoxin affects the mucous membranes favorably it is not likely to produce bronchitis or pneumonia. Possibly Lennox Browne feared this alleged effect when he considered the use of antitoxin contra-indicated during the existence of a bronchopneumonia.

It has also been accused of developing a latent *tuberculosis* into one of more rapid progress. That is barely possible, inasmuch as every fever, for instance after vaccination, is held to have a similar effect. But it is very much more probable that the invasion of the Klebs-Löffler bacilli and of the streptococci of the diphtheritic attack, according to previous statements referring to their complications with tubercle bacilli, leads to the outbreak.

A secondary fever, lasting a day or longer, has been observed after ten or fourteen days; it often coincides with an eruption of urticaria, and seems to be a legitimate symptom of the latter. In most cases, however, another etiology is more probable. It is more often connected with the diphtheria than with the antitoxin treatment. In many cases there may be a new invasion, mostly cocci; there may be an abscess, a rhinitis, a tuberculosis.

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With an abscess, or still more commonly with rhinitis, lymph bodies will swell and the temperature will rise.

After an injection of antitoxin *vomiting* and *diarrhœa* have been noticed and have been explained as the result of intoxication with a fibrin ferment. On the other hand, Baginsky is positive that he has seen those symptoms less often after antitoxin than in cases of diphtheria not so treated. It appears not improbable that the blind confidence in antitoxin has something to do with an occasional case of gastrointestinal irritation. For with some every other treatment is neglected, while antitoxin is being administered, and it is quite possible that abundant membranes not removed by irrigation, while being rapidly loosened and thrown off, are swallowed.

Albuminuria and *nephritis* are not at all met with after the injection of antitoxin by some observers (Riether in none of 1450 cases); frequently by others (Soltmann in 72 per cent.). They occur within a week. Sörensen reports no albuminuria when he operated with Danish serum, but many cases after the use of French serum. That experience would go to show that either the normal horse serums were different, or that the preparation of the antitoxin was not identical. The small amount of phenol contained in it should not be accused, for it is too minute even to be discovered in the urine. What should not be overlooked is the fact that both albuminuria and nephritis are common occurrences, beginning in the very first week of a diphtheria, sometimes within a few days, before antitoxin is administered or has had time to take effect. Among 181 cases of Heubner's of those injected on the first day of the disease five-sixths remained free; on the second, two-thirds; on the third, one-half; on the fourth, one-third. In 525 cases of Baginsky's treated with antitoxin there was albuminuria in 40.95 per cent., clinical nephritis in 12.57 per cent., and post-mortem nephritis in 15.80 per cent. However, among 933 treated without antitoxin there was albuminuria in 42 per cent., clinical nephritis in 25.78 per cent., and post-mortem nephritis in 16.31 per cent.—rather a favorable showing for antitoxin. In Strassburg (Sieger, in Virchow's *Archiv*, 1897) renal

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affections were frequent after the injection of antitoxin; but though some of them lasted weeks or months, they were benign and without morphological elements in the urine.

In some cases albuminuria will change, either totally or partially, into albumosuria, under what appears to be bacterial or antitoxin influence.

The existence of the after-effects is not denied by any of the most enthusiastic admirers of antitoxin, but it is claimed by all that no serious or lasting bad results follow, and that if every life threatened by diphtheria were known to be protected by the alleged untoward or uncomfortable effects of the remedy, we should willingly submit to them in every case. The balance of what we know of antitoxin is thus far favorable, and this addition to our therapeutical powers will forever be remembered as creditable to Emil Behring. The lack of recognition which was some time ago withheld from him by many was, most unfortunately, his own fault. The morbid vanity and some personal motives displayed in almost every one of his writings tallied so badly with the tendencies and the spirit of a scientific benefactor as to render suspicious both his veracity and his motives.⁷ Still, the grateful medical profession and the public will not forget his work. That his preoccupation and his limited horizon should dwarf his judgment is a matter of regret. It is a pity he is not a clinician, but only a scientific famulus. If he were a clinician he would not have been tempted into asserting that organotherapy has accomplished nothing, that cellular pathology has proved sterile, that remedies combat main symptoms only, that medicine has had hitherto therapeutical principles only but no therapeutical experimentation,

⁷ This was written in the first edition of my "Therapeutics of Infancy and Childhood" some years ago. Those who thought I was too severe in criticising the motives of the man have since learned that he has obtained in this country, where no physician deigns or would dare to descend into the arena of bargaining and shop-keeping, a patent right on his wares, which I am credibly informed secured him more than a million marks in a single year in his country.

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and that his experimental therapeutics is in conscious opposition to medication (German Congress for Internal Medicine, June, 1897).

Behring himself explains the occurrence of undesirable effects of his serum only by the accidental and indifferent albuminoids and salts contained in the serum. They are according to him greatly reduced by increasing concentration, even to the dry state which he succeeded in obtaining. In the concentration the antitoxin is "absolutely uninjurious, without poisonous effects in man or animal, healthy or sick." According to H. C. Ernst, J. N. Cooledge, and H. A. Cooke (*Journal of the Boston Society of Medical Science*, May, 1898), the antitoxic property of antidiphtheritic serum can be removed from one part of the serum and added to another by a method of fractional freezing, the bottom layers showing greater strength. By this method serum of high potency, more or less permanent, can be obtained.

Like Behring, Henry W. Berg (*Medical Record*, June 18th, 1898) attributes undesirable effects, eruptions following the administration of antitoxin, to some original impurity. "It is probable, almost certain, that many of the eruptions are due to a toxalbumin contained in the serum of the horse which should be strained through a fine Chamberland filter. Neither the pure serum of the horse nor the diphtheria antitoxin loses any of its power by filtration."

The adversaries of antitoxin have tried to make it responsible for diphtheritic *paralysis*, without any reason. It is true that there are many cases of paralysis occurring in children previously treated with antitoxin, but it has always appeared to me that the number was swelled by some of those who would have succumbed without antitoxin long before the period of paralysis was due. Apparently mild cases of diphtheria are followed by paralysis; it is certainly true that many a case is changed into a mild one by antitoxin. It is after all better to have a paralytic child with the great probability of a final recovery than a corpse without even a chance of paralysis. Moreover, I cannot imagine a more difficult task than to

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calculate statistics on totally absent bases. The average number of paralyses varies according to the cases, the severity of the epidemics, and probably to the treatment also. And finally, large numbers of cases, like those of Baginsky, appear to prove the contrary of what has been alleged. Among 993 patients before serum therapy was introduced there were 68 cases of paralysis, or 6.8 per cent.; among 525 in the antitoxin period there were 27, or 5.14 per cent. Schmidt Rimpler feels certain that his patients with accommodation paralysis recovered more speedily under the use of antitoxin than without it.

Sudden deaths have occurred after the injection of antitoxin, the doses being in some instances quite small. The case of the Langerhans child in Berlin, who died after having received an injection of antitoxin, is not explained in spite or because of loud vituperations and vilifications. Most reporters of cases have been satisfied with the admitting they know of no explanation. Belin publishes one of the latest cases, and admits that death cannot positively be attributed to the influence of the serum. Nifong (*Medical Review*, May 7th, 1898) gave a boy of fifteen years, of slight build and with feeble circulation, fifteen hundred units. After ten minutes there were pallor, numbness of the extremities, cyanosis, swelling of the face, and vomiting. Death occurred in thirty-five minutes. Two girls received the same dose of the same serum obtained from the city chemist of St. Louis without a bad result.

Rauschenbusch observed on his four-year-old daughter, who had taken three times the dose while sick with diphtheria two years previously, pruritus, urticaria, vomiting, sopor, and heart failure after two hundred units injected for the purpose of immunization. It does not appear that a connection between heart failure and sudden death on the one hand and antitoxin on the other has been established in any case, and venturesome and generalizing speculations are not able to shed light on obscure subjects. At all events, a single finding, a suggestion, or a suspicion of vomiting and aspiration of a solid body into the air passages, or of the injection of air into a vein, or excitement and fright, or a lymphatic state, or a large thymus,

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if at all applicable to an individual case, does not permit of a universal interpretation.

After all, we can well agree with the conclusions of Dieudonné when he says that the treatment of diphtheria with serum is an essential advance in therapeutics, that its effect is more frequently favorable than that of former methods, and that accessory consequences do not outweigh the useful effects.

H. Biggs recapitulates many of his previous writings in a paper read before the Society of the Alumni of Bellevue Hospital, as follows: "Since the introduction of antitoxin treatment the mortality of diphtheria is reduced to one-half, its course is shorter and milder; an injection made within the first two days reduces the mortality to five per cent.; the earlier it is made the better the result. Small quantities of concentrated serum are tolerated by the very youngest babies. If antitoxin is not a specific it is certainly the best remedy in our possession against diphtheria. The genuine (that is, uncomplicated bacillary) cases are more amenable to its favorable influence than mixed infections. It has no secondary effects on heart, kidneys, or nerves. Heart failure and paralysis whenever observed are caused by diphtheria, not by antitoxin."

THE PATHOLOGY AND TREATMENT OF THE DIFFERENT FORMS OF CROUP

THE term of "Croup" has been applied to many widely different conditions. All of these conditions, however, have one symptom in common, viz., dyspnœa, or attacks of dyspnœa, bordering on suffocation, and depending on local obstruction of the, or in the, larynx. As I do not pretend to give an essay on croup complete in all its bearings, I simply refer to the immense number of text-books, articles, essays, and monographs written on the subject. The subject of this paper is wholly practical, mostly clinical. It is based almost exclusively on my own observations, examinations, and experience. Thus, if I have to spend some time in speaking of things known to all, I beg your pardon and indulgence; and for what I have to state that is unexpected or uncalled for, your approbation or refutation.

The mildest form of what is frequently called croup, and in severe cases may actually prove deserving of the name, is acute catarrh of the larynx. Its causes are very numerous. Inhalation of cold air, of dust, or other irritants; contact of a hot liquid with the lining membrane of the larynx; over-exertion of the voice; the influence of cold temperature diminishing that of the body, particularly neck, throat, and feet, and mostly in individuals with thin epidermis and a great tendency to copious perspiration; spreading of the catarrhal process from the nose or bronchi, or the pharynx, for instance after the inordinate use of snuff or alcohol, to the larynx, in the contiguity of the tissue. Besides, there are a number of general diseases, which are complicated with, or exhibit amongst their symptoms, a catarrh of the larynx; thus measles, scarlatina,

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variola, erysipelas, typhus and typhoid fever, and influenza.

The anatomical lesions found in persons who have died while affected with catarrh of the larynx do not always correspond with the symptoms encountered during life. The mucous membrane of the larynx is so replete with elastic fibres that after death even, the blood is squeezed out of the dilated capillaries. In very severe forms of catarrh, small apoplexies, ecchymoses occur now and then, and will be found after death, occasionally. The mucous membrane is denuded of the normal vibratile cylindrical epithelium which forms the uppermost epithelial layer of the larynx. The mucous membrane is reddened, moist, succulent, loose in its tissue; the sub-mucous tissue is now and then œdematous, and sometimes, even in an acute catarrh of quite a recent date, small superficial ulcerations have been found. Thus the anatomical changes left in the mucous membrane of the larynx, after death, fully correspond with those found in the mucous membranes of other organs. Sometimes the traces of catarrh are clear and distinct, sometimes nothing is found in post-mortem examinations. An example of this fact is the occasional absence of all and any post-mortem results in children who have died in a severe attack of gastro-intestinal catarrh, so-called cholera infantum. While in some there are all the traces of catarrh, and its sequelæ, from simple hyperæmia to follicular ulceration, there is no alteration in others.

The acute catarrh of the larynx, as mentioned, with its capillary injection, its throwing off and rapid disintegration of the epithelium, and its œdematous infiltration, is by no means universal in all cases. In some, the epiglottis, or the mucous membrane of the inferior vocal cords, or the Wrisbergian, Santorinian, and arytenoid cartilages; the aryepiglottic folds, the true vocal cords, or the inferior part of the larynx, may be affected either separately or contemporaneously, with or without a similar affection of the contiguous regions between nose, pharynx, and lungs. The symptoms of the affection will frequently vary in correspondence with these anatomical differences.

The acute catarrh of the larynx is seldom, from the be-

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gining, a feverish disease. The patients feel comfortable, and the functions of the diseased organ alone are abnormal. There is a certain degree of sensibility in the region of the larynx, a burning or itching sensation. The voice is altered, becoming indistinct and hoarse, in consequence of the thickening of the margins of the vocal cords, which the muscles are no longer able to force into as many vibrations as before. Besides the itching and burning sensation, and hoarseness, there is another symptom present, namely, severe cough, occurring in paroxysms, as if produced by some foreign body touching the mucous membrane of the larynx. Expectoration is not copious; in the commencement of the disease there is none, or it is clear and serous, containing some few cylindrical epithelia, and a few from the lower layers. In the other stages of the disease, particularly in the course of recovery, the expectoration becomes more consistent, more purulent, and yellowish. In a somewhat advanced age only will children remove their expectoration voluntarily; they will swallow whatever touches their fauces, and therefore it is very difficult sometimes to obtain any information as to the nature of the expectorated substances. Physical exploration by means of the laryngoscope yields, at this age, and with the uncontrollability of most children, but few results.

The sub-mucous tissue is much swollen in some exceptional cases only, as far as adult persons are concerned. For the glottis, and particularly its posterior third, forms a pretty large opening in adults, and the entrance of air into the respiratory organs is not prevented by the tumefaction of the mucous membrane. Even children do not suffer very often from constant dyspnœa, in consequence of a simple laryngeal catarrh. Although in them the glottis is short and narrow, the swollen chordæ vocales, by means of the constant and uninterrupted action of the posterior crico-arytenoid muscles, are sufficiently distant from each other not to prevent the entrance of air. But sometimes children, who have been coughing and hoarse during the day, without feeling sick, will be observed to awake suddenly in the night, with an attack of suffocation. In-

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spiration is extremely difficult and exhausting; in the utmost height of their anxiety and trouble, the children will roll about, stretch their necks and grasp their throats; their cough is hoarse, rough, barking. These attacks have been and are very often mistaken for croup, have been and are described as pseudo-croup, false croup, and usually disappear without leaving a trace, after a duration of one or a few hours. These are the attacks which readily disappear after the administration of hot milk, or hot sponges over neck and throat, and by emetics, and which have won for these remedies the reputation of being infallible in croup, when given in time. You may be certain that all the children who are reported to have suffered from croup four, six, and twelve times, and have always been saved were simply suffering from attacks similar to those of which I have just been speaking. Perhaps the sudden attacks of suffocation are produced by a momentary swelling of the mucous membrane and narrowing of the glottis, which the muscular action could not counteract, as sometimes a nostril is thoroughly impermeable in consequence of a severe cold. But it is better explained in the following manner: The suffocative attacks almost always occur in the course of the night; they diminish and disappear, after the child has been awake for a time, with screaming, coughing, and vomiting; and will appear anew after the patient has again fallen asleep. From this fact it is probable that the cause of the sudden suffocative attacks is due to the exsiccation of a collection of tough secretion in the larynx and glottis. At all events, the quick operation of the above-mentioned remedies is best explained in this manner. Thus I always give the advice, during the first two nights of an acute laryngeal catarrh, not to let the children sleep beyond a certain time. Awake them from time to time and let them drink. I prefer them to cough more frequently and mildly to exposing them to violent spells of both coughing and dyspnœa.

Some have attributed a large part of the symptoms to spasm; the affection has even been called spasmodic laryngitis. Now, actually every cough, no matter of what sort, is a convulsive action, but this is not the meaning of those

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who emphasize the spasmodic element in this affection. They lay stress on the presence of a *constant spasmodic condition* of the glottis. But the intermission of the symptoms refutes that assumption, and the only real affection of the glottis in this disease, namely, thickening of the vocal cords, resulting in obstruction, excludes intermission in toto. Moreover, the sound of the cough is hoarse, or barking. Those, however, who are acquainted with the inspiratory spasm of the glottis, or the inspiratory muscles, that is, diaphragm, intercostales, scaleni, serrati, as in whooping cough and in laryngismus stridulus, or so-called crowing inspiration of children, know that the convulsive sound is sibilant, higher in the scale, in consequence of the narrowing of the glottis. The same sound is produced even in expiratory spasm, which, however, is very rare. It is known that, under common circumstances, expiration is simply the passive result of the elasticity of the lung tissue. Thus expiration is always incomplete, part of the gas remaining in the lungs. It may become more complete by the aid of the abdominal muscles, especially the transversus abdominis. Thus we can speak of expiratory spasm or paralysis in some, though rare, cases, but even in these the sound of the cough, and the intermission of the symptoms, refute the presence of a spasmodic element in acute catarrh of the larynx. We are but too prone to fall back, for the explanation of pathological symptoms, on the nervous system, of which we know still less than of the rest. Facts frequently disagree with our comfort and convenience.

Thus far I have mentioned but such symptoms of acute laryngeal catarrh which, as slight swelling of the mucous membrane, oedematous infiltrations of the sub-mucous tissue, and occasional dyspnoea, will readily get well either spontaneously or on expectative or simple treatment. It is easily understood, however, that the symptoms may be grave in consequence of real and complete obstruction or closure of the glottis.

This may be the result of two different conditions:

1. Direct contraction of the lumen of the glottis by considerable tumefaction of the true vocal cords; by tume-

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faction of the inferior vocal cords covering the inner margin of the superior ones; by swelling of the posterior wall of the larynx; and by an accumulation of secretion brought about by the impeded function of the congested and œdematous larynx.

2. Deficient dilatability of the glottis, that is, impeded motion of the arytenoid cartilages, and the true vocal cords; by swelling of the integuments of the Santorinian and arytenoid cartilages, and subsequent immobility of these cartilages and the true vocal cords inserting on the vocal processes; and, finally, by paralysis of dilating muscles.

When such complete obstruction takes place, the same symptoms as those of membranous croup, or foreign bodies, or polypous growths, or acute œdema, obstructing the wind-pipe, will appear, with the same indications and the same results, unless these indications are fulfilled.

As to the course, duration, and termination of the milder form of acute catarrh of the larynx, it may be added that usually after a few days the larynx ceases to be as sensitive, the cough subsides, the hoarseness vanishes, and the disease terminates in recovery, after a week or two. But a duration of several weeks is not uncommon, and do not forget that the infantile organism has a great tendency to inflammatory affections, and to the exudative processes, and that the infantile vocal cords will not bear so well as those of adults, a thickening of their substance and a considerable narrowing of the rima glottidis. The patient may be apparently well during the day but troubled by attacks of coughing every morning and night, and this state of things may last for a long time, until the catarrh and its consequences have become chronic, and removable with difficulty only. But more serious consequences may follow the slightest dyspnœa, continuing for a long time; a smaller amount of oxygen enters the blood than is necessary for normal combustion, and for a complete and regular physiological metamorphosis of the organism. This is undoubtedly proved by the assertions even of adult patients, suffering from slight laryngeal catarrh, who will experience suffocative attacks, and surprise you by showing a mass of mucus brought up after long coughing, dry, hard, some-

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times slightly tinged with blood, and exactly bearing the outlines of Morgagni's fossæ between the superior and inferior vocal cords, or some other part of the larynx.

It is a remarkable incident that just the reverse of what has been presumed to be correct, is so. The fact that children die of croup, who on the post-mortem table do not exhibit much anatomical obstruction in the larynx, proves a paralysis rather than a spasm of the larynx. Animals whose pneumogastric nerves have been cut, and whose glottis is paralyzed in consequence, die with the exact dyspnœa of croup. Moreover, let us consider for a moment in which condition the mucous membrane, the sub-mucous tissue, and the muscles of the larynx may be found. There is succulence, swelling, œdema. There is in consequence of this condition of the mucous membrane, œdematous infiltration and paleness of the submucous tissue and the muscles. Thus, to prove by analogy, in pleuritis the intercostal muscles are paralyzed and bulging out; in peritonitis and enteritis there is succulence, œdema, and paralysis of the muscular layer of the intestine, by which the absence of peristaltic motion and the prevalence of flatulency and constipation must be explained. The same pathological fact holds good for the several constituent tissues of the larynx.

Further: the base of the two arytenoid cartilages forming (by stretching forward and inward) the vocal processes, are very large in adults, so large, indeed, as to form a triangular surface, the "pars respiratoria" of Longet. This part does not exist in children, as the base of the cartilages is but narrow, and thus the glottis from anterior to posterior is but a uniformly narrow slit bordered by the vocal cords. Now when the air in the trachea is rarefied and a full current of air falls on the vocal cords, and the dilators of the vocal cords, namely, the posterior crico-arytenoid muscles, are paralyzed, the vocal cords, oblique in their relation to each other, are approximated, or entirely closed. By sucking the air out of the trachea of a child from below, this fact can easily be verified in the fresh anatomical specimen. Thus when the symptoms of croup are the result of membranous obstruction of the

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larynx, both inspiration and expiration are impeded; when of paralysis, the inspiration suffers more seriously than expiration. This latter is especially the case, when the pharynx is implicated in the croupous process, as in so-called descending croup. For it is the mucous membrane of the pharynx which forms the integument of the mm. crico-arytenoidei portici, which in normal inspiration, when healthy, enlarge the glottis.

As far as the treatment of acute laryngeal catarrh, or spasmodic laryngitis, or pseudo-croup, is concerned, it is better to accustom healthy children to the usual causes of the affection than to guard them too cautiously. Such as have been affected before, will be most liable to be taken sick again. They ought to be dressed carefully according to the temperature of the atmosphere. If there is anything as injurious as it is unæsthetical, it is the naked shoulder and leg of a shivering child. But they ought to be accustomed to inhale fresh air, and to the free use of cold water, river and sea-bathing. Such will be the most efficient preventives. Common cases of acute laryngeal catarrh, produced by atmospheric influences, require warm foot-baths and mild diaphoretics, hot tea or milk, subacetate of ammonia, tartar emetic in small doses; the irritation of the skin by hot sponges, sinapisms, and the application of cold water to the throat; a severe attack of suffocation or dyspnoea will now and then require an emetic: ipecac in infants, ipecac with tartar emetic in more advanced age. I state, however, that I take exception to the too general use of emetics in these so-called cases of croup, when no other symptoms but hoarseness or a barking cough show themselves. In cases of serious dyspnoea alone they ought to be administered. This much I can assure, that not one out of a dozen of the children entrusted to my charge are punished to such an extent in this affection. Wherever a complication is found of pharyngeal with laryngeal catarrh, astringent gargles or applications, or inhalations of tannic acid, or alum, or nitrate of silver, in strong solutions, or in substance, are useful. Even when not applied to the larynx directly, they will frequently prove beneficial by contracting the dilated blood-vessels

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of the contiguous membrane, and thereby influencing the catarrhal condition of the larynx. Permit me, however, to exclude from this remark the effect of the gargles. If they are expected to have the same influence on the distant portions of the pharynx and the larynx, as the direct applications by the probang, no matter of what form, or the pulverizer, their effect is overestimated. In the act of gargling, the liquid does not reach further than the velum pendulum, and the anterior aspect of the tonsils at the best, and for the reason of this plain physiological fact, that whatever is thrown beyond will certainly be swallowed and not ejected again, we ought not to expect too much from their use.

No blood-letting, local or general, is beneficial. Fatty food is injurious; vegetable acids are beneficial; so are alkalies. Whether the chemical composition of the mucus, which contains more chloride of sodium than the blood, thereby depriving the blood of this salt, or the physiological effect of bicarbonate of soda, restoring the vibratile action of the cylinder, epithelium, has anything to do with this beneficent effect, I hesitate to assert. The temperature of the sickroom is to be mild and uniform, the air moist, and every exertion of the larynx, speaking, crying, coughing, must be avoided, prevented, or prohibited. Many an attack of coughing may be frowned or scolded down in older children; for frequently it is the giving in to the first slight irritation to cough which gives rise to a severe attack. The best means, however, to suppress the irritation of the laryngeal mucous membrane is the internal administration of narcotics. It is hardly worth while to try hyoscyamus, belladonna, hydrocyanic acid. You will always find a moderate dose of Dover's powder, or morphia, or codeia, administered several times a day, or a larger dose at bed-time, to yield a favorable effect in soothing the irritated mucous membrane of the larynx, and in suppressing, or at least diminishing, the trouble and the danger from continued coughing.

The number of so-called expectorants administered in laryngeal catarrh, as in that of the rest of the mucous membrane of the respiratory organs, is very large indeed:

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ipecac, squill, senega, tartar emetic, sanguinaria, and id genus omne. My own opinion of their value is not very great. I hardly ever prescribe them. As this is so, I have to beg your pardon for swelling their number by two others. One is the oxysulphuret of antimony, similar in its chemical composition to kermes mineral, on the expectorant qualities of which I published an essay in the *New York Journal of Medicine*, ten years ago. After the fever of catarrhal affections has subsided, and where no diarrhoea is present, and the powers of the patient not absolutely low, it may be given, in doses of from one-fourth to two grains, from four to eight times a day. It does not exhibit the depressing nor the purgative effect of other antimonials, although after a while it will be discovered in the passages, unchanged; and may be given as a powder, or in mixtures, with or without adjuvants, or sedatives. The other is the hydrochlorate of ammonia, or chloride of ammonia. The so-called resolvent, anti-neuralgic, anti-rheumatic effects of this salt have been mentioned, and sometimes extolled, in Great Britain and in our country. It was sometimes spoken of as a powerful remedy, undoubtedly because of its being an ammoniacal preparation; and I have sometimes read, and heard of late, of its wonderful effect, and the possibility of its being a dangerous drug. The truth is, that its powers of both injuring and benefiting have been greatly exaggerated. For decennia, while it was comparatively unknown, and sometimes feared, in England and America, it was the common accommodation drug of German practitioners. In doubtful and plain cases, danger or not, indication or not, if no other innocent or convenient thing would strike the non-inventive genius of the practitioner, chloride of ammonia was resorted to. It was the squills or the calomel of the Englishman. You would find as many recipes with chloride of ammonia on the counters of a German, as calomel on those of an English drug store. Thus it may be considered probable that its strong or injurious effects cannot be very marked. What I can say of it is this: I have no high opinion of its effects except those referable to the mucous membrane, particu-

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larly of the respiratory organs. Its effects on the mucous membrane of the stomach and intestines are far inferior to those which may be obtained by a judicious use of emetics, alkalies, and acids, especially the bicarbonate of soda, and the muriatic, or the nitromuriatic acids, or the usual salts of silver or bismuth. But its effects on the mucous membrane of the trachea, larynx, and bronchi are marked, in all such cases, but in those cases only, in which the liquefaction of a tough, hard, viscid secretion is required. In a catarrhal affection, when the fever has subsided, and expectoration appears insufficient, it will be administered with marked benefit. Here, and here only, lies its sphere. It may be given in doses of gr. xx. or gr. xl. a day, with or without a sedative to diminish local nervous irritation, hyoscyamus or belladonna; and will be advantageously combined with the same amount of chlorate of potassa or a somewhat larger dose of chlorate of soda, in complications with catarrh of the pharynx. It may be given through the day, while towards bed-time, or at nine or ten o'clock, a sufficient single dose of opium, or an opiate, may be administered. Such are the outlines of the rules according to which the usual form of laryngeal catarrh ought to be treated. Those forms, however, in which a complete obstruction, or an almost complete closure of the larynx takes place, from such causes as enumerated before, and in which the above treatment proves inefficient, require other means to ward off the fatal termination by suffocation. These are the forms which deserve the name of catarrhal croup, and require as sound and quick a judgment as a steady hand. They are not frequent, but they will occur, in every land and practice. Just as surely as a case of polypus, or foreign body in the larynx requiring interference, may be met with any day, although sometimes not in a dozen years, a case of catarrhal croup threatening speedy death from suffocation may be met with. Every physician is acquainted with the occurrence of acute œdema of the glottis, and the necessity for establishing an artificial entrance of air into the lungs, and every one may meet with a case of catarrhal croup in which the omission of tracheotomy is homicide.

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Dr. Kühn has collected 149 cases of foreign bodies in the larynx, treated with tracheotomy, and 109 recoveries; 73 cases of œdema of the glottis, and 54 recoveries; 52 cases of syphilitic laryngitis, and 39 recoveries; 28 cases of perichondritis and necrosis, and 5 recoveries; 4 cases of angina tonsillaris, and 1 recovery; 22 cases of epilepsy, and 20 recoveries; 11 cases of wounds of the larynx, and 10 recoveries; 12 cases of combustion, and 6 recoveries; 35 cases of diseases of surrounding organs, and 5 recoveries; 5 cases of polypi, and 4 recoveries.

Such figures are reason enough why the name of those should be remembered and blessed who learned and taught to temporarily supply the lungs and blood with their essential nutriment. We shall soon see that their example is not only valid in cases of walnut shells, bones, copper pennies, pieces of china, coffee beans, pebbles, and sugared corn imbedded in and obstructing the air-passages, but in every sort of air-passage obstruction, both accidental and pathological.

From our considerations of the treatment of croup, however, non-obstructing catarrh on one side, foreign bodies, polypi, ulcerations, with œdematous swelling, as in typhoid fever, typhus, syphilis, tuberculosis, and spasm of the glottis, must be excluded. The diagnosis of true croup has for a long period been thought to be dependent on the presence of membranes, and consecutively the distinction between croup and pseudo-croup, according to their presence or absence, was considered unimpeachable. But there are a number of cases on record in which tracheotomy was performed for croup, and no membranes found. Or after pseudo-croup had lasted and been diagnosticated for days, all at once membranes were found in the larynx, with the exclusion of the pharynx. Or in other cases the symptoms were so urgent that tracheotomy was performed for what was shown to be simple catarrh with considerable œdema, and with or without pharyngeal membranes. And sometimes the membranous deposit was found in the pharynx alone, and nothing beside it, after death. For these reasons a diphtheritic, a membranous, a catarrhal and spasmodic croup were distinguished. But this much

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may be stated here, and practitioners will admit the fact, that the affection will frequently, especially when there is no epidemic diphtheria, commence by "pseudo-croup," and afterward assume a more formidable character. As this is so, the possibility of cutting the process short by proper dietetic measures, provided always that there is no constitutional diphtheria, cannot altogether be denied.

The unbiased examination of all these cases of croup met with yields but one common and essential symptom, namely, obstruction of the larynx, from a nutritive disorder. Its form will differ. Of the anatomy of simple obstructing catarrh I have spoken. Another form is the follicular process of the tonsils with its subsequent changes, the formerly so-called herpetic angina of the trachea, which I have characterized already in a paper on diphtheria, published in August, 1860, in the *New York Medical Times*. It is exudative, membranous in character, feverless, but will not unfrequently be followed by larger croupous or diphtheritic deposits. Another form is the membranous deposit proper, a fibrinous exudation, amorphous in character, mixed with mucus and blood corpuscles and normal epithelium. It is either deposited upon the mucous membrane, and then can be easily lifted up from it, or into it and into its subjacent tissue. The first form has frequently been called croupous, the latter diphtheritic. But whatever clinical difference there may be between a simple membranous inflammation and constitutional diphtheria, there is no anatomical difference between the membranes wherever they make their appearance. Another form, and not a very unfrequent one, is originally confined to the epithelium, which rapidly undergoes fatty degeneration which may or may not be complicated with fibrinous exudation. The soft, pultaceous, easily macerating diphtheritic masses are of this character; and the fearful cases of diphtheria with rapid necrosis of the tissue are usually of the same nature. The neighborhood may be in different conditions, œdematous or dry, hyperæmic or anæmic. Œdematous and hyperæmic condition is more commonly found; a dry condition is a frequent occurrence in the necrobiotic process of that fatty degeneration; an-

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æmia of the surrounding parts, or interspersed portions, depends on compression of capillaries by infiltration, which means new-formed cells and connective tissue; moreover, let us not forget that we have fortunately passed by the time when the nutritive disorder called inflammation was always thought to depend on previous congestion of the parts.

All those forms of change of tissue are not found uncomplicated in every given case. When large surfaces are taken at once, you may see in the mouth a catarrhal proliferation or croupous condensation of the epithelium, on the tonsils a diphtheritic deposit imbedded in the tissue, on the larynx and trachea a plain croupous deposit, and in the bronchi a muco-purulent secretion. And again, under the same endemic and epidemic influences you will find a case of catarrh, a case of croup, a case of diphtheria, a case of follicular exudative amygdalitis, in the same family in the same week. Thus it appears that in the long list of morbid conditions met with, catarrh on one side, diphtheria on the other, are but the starting and terminating points between which all the different shapes and forms may be registered according to their dignity, their modification depending on individual, local, endemic and epidemic influences; the only form which is perhaps, but perhaps only, to be excluded, being the necrotizing diphtheria. And when we compare the clinical nature of the affection we find similar differences. The affection may be local without fever, or simply febril, or local and obstructing, or obstructing and poisonous. In some cases the process will not even be confined to the respiratory organs, but, similar to the rinderpest of animals, the digestive organs will participate in the process, and skin, kidneys, spleen, may follow.

Thus great may be found the difference of the anatomical lesion in croup, but the stenosis, obstruction of the larynx, is the common symptom of all forms.

After the symptoms of tumefaction, succulence, and increased secretion, with their paralyzing influence on the mobility of the vocal cords, and with its barking or soundless voice or cough, have passed by, or without these pre-

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monitory symptoms, inspiration becomes impeded. its duration prolonged, and its sound sibilant. The respiratory efforts are increased in consequence; the levatores alarum nasi active, the muscles of the thorax overstrained. Expiration short, no interval between expiration and inspiration, mouth and nostrils open. The superior portion of the thorax flattened, the supra-clavicle regions sunk, sternum and scrobiculus cord is drawn in; the inferior part of the abdomen bulging out; larynx and trachea ascend and descend considerably with every expiration and inspiration to compensate for the diminished amount of air admitted to the lungs. The flushed face becomes pale, now and then the child is soporous, vomiting will occur spontaneously while emetics are losing their effect, respiration is superficial, attacks of suffocation will alternate with sopor. Sometimes for a change, entire remissions, mostly in the morning, will take place, and the child breathe more quietly and appear more comfortable, until with an attempt at deep inspiration, exactly like animals in whom the pneumogastric nerves have been cut, a fearful attack of suffocation sets in.

Part of these symptoms result from the abnormal amount of carbonic acid retained in the blood; not from retention of the blood in the brain; for as long as inspiration alone is impeded, blood is not repelled into the brain, nor into the integuments, and therefore we notice no cyanotic hue, except in a severe attack of coughing, or except toward the fatal termination when the heart is becoming paralyzed and the arteries insufficiently filled. Then the veins are dilated by the circulation being impeded. To the contrary, when the elastic lung tissue, not sufficiently filled with air of normal density, affords more room for the capillaries to dilate, when there is less pressure on the walls of these lung capillaries, the result is congestion, catarrh, bronchitis, and broncho-pneumonia inside, while the external surface is the paler. Thus bronchial catarrh and bronchitis with its sequelæ—not, however, croupous pneumonia, which requires other causes—is the direct effect of impeded circulation, and therefore the frequent cause of death even after tracheotomy has re-

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lieved the dyspnœa. Cyanosis, and impletion of the veins generally, is the result both of impeded expiration and inspiration, when the larynx is almost fully obstructed by membranes. As expiration can be attended with greater muscular force than inspiration, the blood will effectually be repelled into the venous system. Thus will occur direct brain symptoms not depending on carbonic acid poisoning; from this source the immense and dangerous dilatation of the veins of the neck and thyroid gland as met with in many cases of tracheotomy; from this source also, local or general cyanosis. With the exception of a very few cases in which the obstructing membrane is fortunately expelled, nothing else but death can be expected. It will ensue from gradual paralysis, or sometimes from sudden suffocation by loose or nearly loose membranes obstructing the glottis.

Among the most dangerous symptoms in the final development of the process, I mention the following as considerably impairing the prognosis:

1. Emetics administered, and no relief.
2. Emetics administered, and no effect.
3. Constant increase of dyspnœa.
4. No more remissions between the attacks of suffocation.
5. Feeble, frequent, and intermittent radial pulse, the intermission coinciding with inspiration.

The indications for the treatment of croup must necessarily be dependent on its anatomical and physiological character.

The character of croup is: suffocation by insufficient or absent entrance of air into the lungs in consequence of a nutritive disorder of the larynx.

The obstructing causes are either œdematous swelling, or paralysis of vocal cords, or presence of membranes, or two or all of these factors. The indication is to remove the one or all of them by the proper means, and to prevent the morbid process from increasing. To give a list of the remedies which have been given in croup for the purpose of drenching the blood and system with a "solvent," "antiplastic," etc., remedy, would be to write a

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list of almost every remedial agent of the pharmacopœia, and would be only a further proof of the well-known fact that the number of "valuable," "inestimable," "infallible," remedies grows with the danger and incurability of the disease.

Those who have seen in croup nothing but a common and always uniform affection of inflammatory character, have administered mercury in almost any form, calomel in small and large doses, the bichloride, the sulphide, or the alkaline carbonates or bicarbonates, or the sulphide of potassium. Those who saw in croup nothing but just a more or less innocent continuation of the follicular process of the mouth in a downward direction, relied on the chlorate of potassa or soda. Others would rely on the sulphate of copper in small doses, until the two ends of the intestinal tube were overflowing with it; others again, who laid more stress on the nervous, and especially spasmodic, symptoms, would lead into battle the salts of quinia and morphia, the narcotic extracts, belladonna, hyoscyamus, asa-fœtida, also nux; such as had seen symptoms of infection with croup would rely on the muriate of iron, nux, bromine, carbolic acid. All of them have been considered infallible by their godfathers, and all of them are known to fail.

I do not mean to make the slightest attempt at refuting them, first, because it requires more time than I, and more patience than you, have. If a case getting well under a treatment, or in spite of a treatment, is to give credit to this treatment in the eyes of the short-sighted, we cannot help it; we can simply deplore the still prevailing omnipotence of the "post hoc ergo propter hoc."

One of the indications was, treatment of the paralysis of the vocal cords. Can we expect to remove this paralysis, say by electricity, which is the most powerful antiparalytic remedy? It appears not, for the simple reason that this paralysis is secondary. It depends on the œdematous soaking of the posterior crico-arytenoid muscles following the œdema of the mucous membrane of the crico-arytenoid folds. Thus this paralysis cannot be influenced except by removing this œdema from mucous membrane and muscle. This appears impossible, for instance by an incision, scarifi-

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fication, because it is not local. You would possibly by a well-directed scarification diminish it, but not remove it. Even local œdema glottidis has been known to require tracheotomy after scarifications had been freely made. Moreover, the case is more unfavorable still for a direct interference. The very œdema of the mucous membrane (and sub-mucous tissue), of the crico-arytenoid folds giving rise to the paralysis of the glottis is itself but secondary, the original cause being almost in every case the diphtheritic and œdematous condition of the pharynx. After all I have said, it appears doubtless that we have to give up the idea of interfering with, or removing, the paralysis of the glottis as met with in croup, the nature of the paralysis itself being as much the cause of this impossibility as the rapid course of the morbid process. A mild case may find time to get well, a serious one will suffocate.

The next indication, in case membranes are deposited, no matter whether of the hard or pultaceous character, is to remove these membranous deposits.

For this purpose there have been recommended:

1. Internal treatment.
2. Mechanical treatment.

The internal treatment has been mentioned above; it was meant to have its effect according to the laws either of physiological chemistry, or the pathology of neuroses. The latter has failed. And so is the first sure to fail, in your minds, if I shall succeed in proving that the same remedies which were thought powerful enough to dissolve membranes by their presence in the blood, are entirely powerless to dissolve the same membrane under your eye, in your basin, in constant contact with a stronger solution or dose of the remedy than you would dare to administer internally.

The mechanical or local treatment recommended is the mechanical removal of the membranes within reach, with forceps, brushes, etc.

Application of remedies expected to dissolve or soften the membranes, for instance glycerine.

Application of caustics, and astringents, alum, tannin, chloride of iron, mineral acids, nitrate of silver, by means

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of gargles, direct local application with the probang, the forceps, the brush, or the pulverizing apparatus.

Removal of membranes by emesis.

The gentlemen are sufficiently acquainted with the local application of nitrate of silver to the interior of the larynx, inasmuch as part of the most important literature on the subject is ours. The name of Horace Green is more deserving of the respect of Americans for his local treatment of the air passages—his treatment of croup I should not, however, include in his great improvements in science and art—than that of Loiseau of that of the French. Now, it has been presumed that nitrate of silver would prove very destructive to the laryngeal false membrane, and therefore has been widely recommended. But I wish to remind you of the results of your local application to the pharynx in cases of simple diphtheritic deposits. Unless you take, and are allowed, a rather long time, to mechanically tear up and destroy the membranes, with some effort and even violence, you will not succeed. The membrane is even apt to shrink and harden, is not destroyed, its base is intact, and a new crop may follow. It is characteristic in nitrate of silver that its effect is so very much confined to the exact point it comes in contact with. In a few minutes I shall have to relate a frightful proof of this fact.

Thus the very virtue of the agent is a drawback where you want extensive destruction and a quick effect. A long-continued application is out of the question. I have lost a child, in whose larynx I operated with a saturated solution of nitrate of silver, by instantaneous death. And those few cases which I have read of, and one or two cases that friends have reported in medical societies, cases in which the probang with a solution of nitrate of silver proved effective, prove, in my opinion, nothing for the nitrate of silver, but everything as far as it goes for the moist probang with its direct mechanical effect, and its indirect effect in producing coughing, etc.

We ought not to forget that the local treatment of croupous or diphtheritic membranes in the pharynx when desirable, is a great deal easier than in the larynx. The

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facility is greater, and the organ neither so vital nor so vulnerable. And what applications to membranes may be expected to do, will be seen by the following results of direct experiments, part of which I have had frequent chances to repeat:

Lime water requires thirty to fifty hours to disintegrate false membranes, and three days or more to entirely dissolve them. It requires from four to ten hours to thoroughly liquefy the soft pultaceous diphtheritic deposits.

Hydrates of potassa and of soda, 1:500, act more slowly than lime water.

Potassium permanganate, 1:120, disintegrates false membranes in its outer parts, while the interior remains hard and solid, in ten hours.

Carbonate of lithia and carbonate of soda, 1:100-150, had the same effect in the same time. About the same time is required by the constant effect of chlorinated water.

Sodium nitrate, 1:200-300, has no effect on membranes. Iodine, the officinal tincture, or a solution of 1:200, shrinks and hardens them.

Nitric acid, 1:50, has the same effect. So has acetic acid, except on the soft diphtheritic masses, which get disintegrated.

The only agent which dissolves membranes soon, but one which is hardly fit for use for obvious reasons, is ammonia.

Carbolic acid, applied to a membrane or a pultaceous diphtheritic deposit, shrinks it in a short time, making it removable to a high degree. The difficulty, however, of applying it to the larynx and bringing it into contact with a sufficiently large surface is very great indeed. To normal tissue it is not without danger. Thus I am not prepared to say what it may be made to do in croup of the larynx, while I am pleased with its local effects in the same affection of the fauces. To act quickly it must be applied very little, if at all diluted, and requires an experienced hand.

Subsulphate of iron and sesquichloride of iron act, although, perhaps, not so vigorously, similarly to carbolic

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acid. They have, however, the disagreeable property of shrinking and coagulating, and as it were accumulating in a bulk, whatever of albuminous substances is in reach. Thus mucus and blood are coagulated and form with the iron a firm, hardly removable mass, which may interfere with both deglutition and respiration, and give rise to great annoyance. And another one which it will be worth while to experiment with is bromine. One grain of bromine, one grain of bromide of potassium, in three hundred and sixty grains of water, will liquefy a membrane in a few hours.

Thus it appears that unless bromine will prove effective, it is not worth while to try the effect of anything but lime or carbolic acid. This much is sure, that it will prove effective, to a certain extent, where it can be retained in contact with diphtheritic masses. Thus I am pleased with their effect in nasal diphtherite, where the deposits are frequently softer, thinner, half solid only. Frequent, say hourly, injections of lime water into the nose have evidently rendered me good service; how far, however, this effect will show itself in the larynx, where the application cannot be made so thoroughly nor so frequently, or how far the few reports of a cure by the inhalation of pulverized lime water can be trusted, remains to be seen. At all events, the scarcity of the reported successes—and we may be sure that real or apparent successes in the treatment of croup will not be concealed—is in exact proportion to the insolubility of false membranes, and to the rapid course and usual fatal termination of the disease.

Concerning the removal of membranes by emesis, we know that emetics stand almost foremost in the list of the remedies recommended in every form of croup, for their revulsive and diaphoretic, and their mechanical effect. Of the first I have no idea unless it means the second. My opinion of this, the diaphoretic effect, and the necessity or advisability of diaphoresis, I have briefly stated. Thus, no effect but the mechanical one appears reliable; and it is reliable in some cases. When the dyspnoea depends on the collection and accumulation of mucus in the larynx, or when mucus is one of the factors

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only, it will alleviate the symptoms, and may be resorted to and repeated. When the obstruction is membranous, it will be of less importance, inasmuch as the membranes are mostly closely attached in the beginning, that is, for days, to the larynx, especially in those places which, like the fossæ Morgagni, are less exposed to the current of air from the lungs. But the effect of the emetics is greater than that of the most severe spell of coughing, because of the dilatation of the glottis which takes place during vomiting. In this dilatation a larger portion of the larynx is exposed to the current of air emanating from the lungs than in coughing. Thus there is hardly an objection to trying the effect of an emetic in a case of membranous obstruction of the larynx, which will best be diagnosticated by the expiration being impeded like inspiration, with a view of detaching it from the walls of the larynx; especially is it indicated when membranes are partially loosened. This condition is sometimes diagnosticated amidst the most urgent dyspnœa by a peculiar loud, clashing, flapping sound, particularly in expiration. Whenever relief is obtained, it ought to be repeated from time to time, not otherwise. When the symptoms of general paralysis from deficient decarbonization of the blood are on the increase, reaction will cease, and emetics will withhold their effect, even at a period where spontaneous vomiting may still take place. When such is the case the most powerful of all irritants, cold effusions to the head, or neck, or the pit of the stomach, may still rouse the reaction of the oblongated spine and the pneumogastric nerves.

Of the remedies which ought to be resorted to I have spoken already. I prefer the sulph. cupri to any of the rest. The mode of their producing emesis is the same, and as emesis only is required, the most reliable medication ought to be selected.

The indication of cutting short the process of obstruction, to interrupt the course of the disease, has appeared to many to require the use of diaphoretics, depletion, vesicatories, warm applications, or cold applications.

Diaphoretics.—Their effect is perceptible in cases of simple catarrhal hyperæmia only. The dilatation of the

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capillaries of the surface is apt to empty internal blood-vessels. Thus it is rational to try diaphoretics in cases of catarrh, or wherever for a little while the diagnosis between catarrh and croup is doubtful. While, however, it would be worse than unwise to expose the body of the patient to cold air, we ought not to forget that it is unphysiological and worse than wasting time to expect the reduction of a nutritive disorder of such an extent from the administration of internal diaphoretics, or diaphoretic external treatment.

Local depletion has frequently been recommended. Leeches were to be applied to the throat, to the manubrium sterni. The same can be said of them as of diaphoretics. They may, not be very injurious in catarrh; theoretically they may even be justified, although the same end is better obtained by more innocent remedies; they may not hurt robust and vigorous children whose strength is not so easily consumed. But again, inflammation and hyperæmia do not always coincide, and exudation is not prevented by leeching. To the contrary, the well-known fact that the proportion of fibrin in the blood increases with every depletion, ought to make us very cautious indeed. Moreover, the danger of local or general depletion in diphtheria ought to be too well understood to be underestimated. For nearly ten years, in this city and over the world, diphtheria has been prevalent, with all its local destructiveness and its constitutional poison; the large majority of cases of croup have been of a diphtheritic character. The result of depletion in such cases is but too often the rapid increase of exhaustion, and the formation of diphtheritic deposits on the sore surface. Thus I consider the use of depletion in croup as excusable in but few cases, although hardly ever indicated; in the majority of cases it is dangerous.

What I have said of depletion is also valid for vesicatories. It is characteristic for diphtheria that not only mucous membranes, but the cutis too, wherever it is denuded of its epidermis, will be readily covered with membranes or pultaceous deposits. Thus eczematous or impetiginous sores will undergo this change; and those who

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have performed tracheotomy or any other operation in a diphtheritic individual, or during the prevalence of an epidemic, have had sufficient reason to be shocked at diphtheria exhibiting its eruption within twelve or twenty-four hours. I have seen dozens of tonsils removed from apparently healthy individuals in such seasons, covered with diphtheritic deposits within a day, and remember to have lost a case of resection of the head of the femur from the same cause. Thus, beware of vesicatories. Their usual result is not a relief, but diphtheritic covering or disintegration of the affected part, and frequently collateral swelling. I do not assert too much when I say that the only effect I have ever seen from their use has been very unfavorable.

Both warm and cold applications have been made to the larynx, externally, for the purpose of alleviating the symptoms, or interrupting the progress of the disease. Can we expect an effect, by either of the two, on the formed and deposited membrane? No. Thus we cannot, in fact, expect to influence the fully developed disease by either. Or on the collateral œdema and consecutive paralysis of the vocal cords? Exactly the same must be true. Now, in inflammatory and exudative processes in other organs and regions we use both warm and cold applications, but it appears to me for different indications, and for different purposes. There is no doubt that warm poultices in a certain advanced stage of peritonitis or pneumonia will do a great deal to promote the absorption of exudation, and the comfort of the patient; but absorption we do not expect in croup of the larynx, and comfort there is none. But wherever we do have a congestive disease, an inflammation based upon hyperæmia, a dilated condition of the blood-vessels, cold applications, when the parts are within easy reach, are the only reasonable means to fall back upon. If this is true of enteritis, peritonitis, or pneumonia, it is so much the more so in affections of the larynx with its easy access and its close proximity to the skin. The only thing I should not like to dispense with in the treatment of croup, is, therefore, ice, which, if anything, is the most simple, unexhausting,

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and direct remedy possible. There is, in fact, no period of croup in which it has any contraindication, although its effect is only to be considered as preventive of exudation.

Of all the remedies as used in croup, we cannot say anything better than that most of them are useless, some injurious. From what I have stated as my experience, and that of hundreds of better men, and from what I know to be the experience of the large majority of the gentlemen present, the great mortality statistics of croup are but too well confirmed. Statements of such epidemics in which seventy or seventy-five per cent. of all the cases of true croup have died, are highly favorable, such with ninety or ninety-five per cent. not at all uncommon.

Thus, very little reliance can be placed on the judgment and the diagnostic powers of such as save a large majority of their cases, or who rely on infallible pet remedies.

As a general rule, I like the bowels of the patient moved by an injection to give his abdominal muscles and diaphragm as fair play as possible. I apply ice in comfortable bags to his larynx. I now and then, according to the condition of the fauces, try sesquichloride of iron, or carbolic acid, to the visible membranes. I have not seen yet that I have succeeded in directly influencing the laryngeal deposits. When the diagnosis is any way doubtful, I allow a mixture of chlorate of soda or potassa with chloride of ammonia, frequently repeated, say one to three drachms of the former to one-half to one drachm of the latter per day. When attacks of dyspnoea or suffocation come, an occasional emetic. When with all this the symptoms become graver, pulse more frequent, or even irregular, and all the other symptoms enumerated before show themselves, I cannot but confess that I have no more power over the process, and that it will, as far as human experience and foresight go, destroy the patient, unless you find the means of supplying the lungs with oxygen.

For this purpose the development of oxygen in the patient's room has been resorted to. How much oxygen they do obtain by such process, is uncertain; it is still more improbable that the patients, in the condition in

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which they are, can be made to inhale voluntarily. Moreover, pure oxygen is not fit for respiration, on the contrary, it causes dyspnœa in the healthy; the mixture in which oxygen is in the atmosphere appears to be the only proper food for the blood, and alone capable of keeping up the diffusion of gases through the walls of the pulmonary capillaries.

For the same purpose Bouchut invented and described his "tubage." He introduced, so he said, tubes between the vocal cords, through which the croupous children would immediately breathe quietly and sufficiently. Now, in a larynx filled with membranous or other diphtheritic deposits, this is a plain impossibility. Only in cases of paralysis of the vocal cords such a proceeding could be thought of. Whether it can be done or endured, I do not know. But I do know that Bouchut has not succeeded himself, inasmuch as he asserts that the children into whose glottides he introduced his tubes, expressed to him their gratitude, by words, immediately after. When reporting on this "tubage" of Bouchut's, Trousseau already stated that the hitherto known laws of physiology would forbid a child to speak with the vocal cords held aside, and steadied by a solid tube in the rima glottidis.

For this purpose, finally, we perform tracheotomy; that is, we afford the air access to the lungs below the obstructed point. Thus tracheotomy is not a cure for croup, it is simply a means to keep the patient from suffocating until the process above has completed its course. As soon as the larynx will be pervious again, you expect to close your artificial opening. Thus tracheotomy appears on a level, but more favorable than these, with paracentesis of the bladder, operation for artificial anus, or thoracocentesis for acute copious effusion. Thus there ought to be no contraindication when the prominent symptom is dyspnœa, and suffocation. I cannot imagine any complication of croup that would prevent me from opening the trachea when the child is dying of suffocation. This is so plain to my understanding that I should consider it even a cruelty to refuse tracheotomy when I knew before-

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hand that the child was surely going to die. Whoever has seen children die of croup, fully conscious, gasping, raving for air until they are slowly strangled in your arms, under your eyes, will at least bless a proceeding, the consequence of which will in most cases be an easier death; with the exception of those in which solid membranes will, after the operation, migrate down into the smallest ramifications of the bronchial tubes.

Nor do I acknowledge that tender age, the age under two years, ought to be held as contraindication to the performance of the operation.

Now, it is a fact that the results of the operation at this age are much less favorable than at a more advanced period. All and every statistical record yields the same evidence. But lately, Güterbock has published one hundred cases of tracheotomy for croup, one of which was under a year, one under two years, both terminating fatally. As far as the rest is concerned of those operated upon, between the second and third year the percentage of recovery was 33 1-3; between the third and fourth year, 40 per cent.; between the fourth and fifth years, 38 8-13 per cent.; between the fifth and sixth year, 44 4-9 per cent.; between the sixth and seventh year, 44 4-9 per cent.; between the seventh and eighth year, 14 2-7 per cent.; between the eighth and ninth year, 25 per cent.

Theoretically, there is no reason for tender age being an excuse why suffocating infants should be left to a sure death. If, however, clinical experience would sustain the contraindication as such, we might be satisfied with leaving them to their fate. But fortunately the case is not so bad after all. For there are a number of cases on record in which tracheotomy performed on very young children proved successful. I will not urge the case of Scoutetten, erroneously attributed to Sedillot lately, who operated on an infant of six weeks, as it has been declared to have been a case of so-called pseudo-croup; although, even if this was so, the advisability and possibility of the operation was clearly proved by this very case. But the cases of Baizeau, in an infant of ten months, and in another of fifteen months; the case of Isambert, six-

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teen months; Archambault, thirteen and eighteen months; Royer, nineteen months; Vigla, seventeen months; Potain, eighteen months; Moutard-Martin, eighteen months; Trouseau, thirteen months; Barthez, thirteen and seven months, prove the very fact that the general indication for tracheotomy, namely, obstructive disease of the larynx, remains valid.

Dr. Krackowizer's earliest case of recovery, in this city, was not two years old. He removed the tube on the child's third birthday, but was compelled to introduce it again for a few days.

The result of my own cases of tracheotomy is as follows: I have operated on sixty-eight children, sixty-seven times for croup, once for a foreign body contained in the larynx. The case was that of an infant of eleven months, who had a flat bone seven lines long and one to four lines wide lodged in the larynx while being fed. The danger appearing imminent, dyspnœa growing from minute to minute and resulting in a general cyanotic hue of the face, and emetics proving useless, help was immediately sought for and the operation of tracheotomy performed about two hours after the accident. The foreign body was dislodged from below upward through the tracheal opening with great difficulty; after it had been removed the dyspnœa was not entirely relieved, and the child did not breathe normally except through the tube only. It appeared that, although there was no longer a foreign body inside the larynx, it had during its stay there worked changes resulting in obstruction. It was, therefore, impossible to remove the tube, symptoms of laryngitis showed themselves after a few days, high fever set in, and the infant died on the eleventh day after the operation, of traumatic laryngitis. The post-mortem appearances were: intense catarrhal injection, intermingled with an occasional ecchymosis of the epiglottis, considerable swelling of the entire mucous membrane of the larynx, and sloughing of the fossæ Morgagni and part of the vocal cords.

Of the sixty-seven cases of tracheotomy for croup, thirty-eight were made on boys, twenty-nine on girls. Of the sixty-seven, thirteen recovered; of the thirty-eight,

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eight recovered, of the twenty-nine, five recovered. Thus, the total percentage of recoveries is about nineteen and a half.

The percentage looks a little more unfavorable than it really is. For there are five cases, boys of two, two, two, and five years, and a girl of nineteen months, who swell the lists of my mortality unnecessarily. One boy died in my presence while I was preparing the table and instruments. A single incision opened the trachea of the child hastily thrown upon the table and pulled over its edge, but too late. In another case I was induced to operate, although I found the little girl dying, by the attending physician, who had been patiently extorting the permission of the parents and waiting for the surgeon for many hours. The other three cases were of a similar description; for hours no emetic had resulted in emptying the stomach, no external irritation yielded a reaction, and if I had had the control of the case I should not have performed the operation. At all events, these five operations were made on individuals who either were dead or dying, and in whom the indication for an operation had long passed by. Thus I am justified, I believe, in saying that there are thirteen recoveries, namely, twenty-one per cent., out of sixty-two operations. You will, besides, please not forget the fact that I have frequently had to wait for the permission to operate for hours beyond the normal indication, and that this very delay has in many cases impaired the chances of the patients. This complaint of mine is as easily understood as it is expressed by all of those surgeons who have operated in a large number of cases, and in other than hospital practice. But the blame is not confined to the attendants and relatives only, it has sometimes been myself who is to be blamed for delay, as I am positive to have lost good opportunities by procrastination. Especially in those cases which take a very rapid course, such procrastination has occurred; it is but too natural, now and then, to hesitate in spite of your exact knowledge of the indication, before you operate on a child who a few hours before was perhaps the picture of health. And still, nobody would think of hesitating when

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a foreign body was located in the larynx, though I reluctantly confess that I believe I have lost lives by losing time. A case of this description occurred but lately. A boy of a little more than two years was taken with hoarseness and moderate fever, and a croupy cough. The message did not reach me before the following morning, when I paid my first visit at 10 a. m. Hardly any deposit on a (the left) tonsil, great dyspnoea, but voice not gone, the muscles of the thorax in thorough exertion, perspiration, pulse of 140. The mother had during the night administered chlorate of soda, and applied ice water to the throat. Treatment continued, with an occasional emetic, until I should call in the afternoon. Visit at 5 p. m. More dyspnoea and perspiration, dyspnoea constant, cyanotic hue of lips and nose, pulse 150 to 160, irregular. Still, I try the effect of an emetic; it takes effect, but gives no relief. Then I call on Dr. Chamberlain for assistance in the operation, which is performed at 7 p. m. The relief afforded by it is striking, but below my expectation; three-quarters of an hour after the operation the respiration is rougher, harsher than normal, 36 to 40, pulse 124 to 128, the patient tolerably quiet, but spells of restlessness, which, however, do not last very long. At 10 p. m. an occasional crepitant râle, 44 to 48 respirations, 150 pulsations, heat of skin increased, no dull percussion sound. I fear a beginning broncho-pneumonia, and state my uneasiness concerning the termination of the case to Dr. Chamberlain, who kindly accompanied me. At 3½ a. m. I was sent for, only to learn that the child had died soon after the messenger went for me. The post-mortem examination revealed, besides the complete membranous obstruction of the larynx, a few thin and small membranes corresponding with the first five or six cartilages of the trachea, intense injection and ecchymotic discoloration of the lining membrane of the trachea and bronchi with their ramifications, a general and intense œdema of the lungs; no pneumonia, no hemorrhage, no collapse of the lung. Those who are conversant with the mechanical influence of the rarefaction of the air inside the lungs, and the disproportion between the tension of blood in the ves-

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sels and the diminished atmospheric pressure on their walls from outside, will be apt to explain the post-mortem appearance and the mode of dying. It has been the only case of uncomplicated, fatal pulmonary œdema after croup and tracheotomy which I have seen, and there are but few such cases on record. The tendency is much more to the development of an exudative than an effusive process, and while broncho-pneumonia is a frequent occurrence, uncomplicated pulmonary œdema is as rare as it is instructive.

Of my patients one was at the age of 1 year 1 month; one, 1 year 2 months; one, 1 year 7 months; one, 1 year 10 months; five, 2 to 2½ years; nine, 2½ to 3 years; sixteen, 3 to 4 years, twenty-three, 4 to 5 years; seven, 5 to 6 years; two, 7 to 8 years; and one 10 years.

Recoveries took place:

1	at the age of	2½	to 3 years,	1	out of 5 operations,	=20	per cent.
3	"	3	" 4	" 1	" 16	"	=19 "
7	"	4	" 5	" 1	" 23	"	=30 "
2	"	5	" 6	" 1	" 7	"	=28 4-7 "

The after-treatment in some of these cases was protracted, and therefore the tube had to remain in some a pretty long time. It was removed in two cases on the 17th day, one on the 18th, one on the 20th, one on the 27th, one on the 29th, one on the 30th, two on the 35th, one on the 42d, one on the 44th, one on the 46th, and one on the 54th day.

The cause of the long duration of the after-treatment was in four cases of a peculiar nature. It was found that in the second week after the operation, the larynx having expelled the macerated membranes, would resume its functions, and the patient breathe normally through the tube and its upper fenestra, and the larynx, the anterior opening of the tube having been closed by a cork. But the removal of the tube from the trachea gave rise to instantaneous attacks of dyspnœa and suffocation, which were instantly removed again by the replacing of the tube. This occurrence would take place so regularly that the patients would not admit the removal of the tube after-

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ward. The cause of this strange and unsatisfactory occurrence was found to be the presence of polypoid excrescences, sometimes numerous, of the size of a pin's head to that of a pea and more, originating on the margin of the tracheal wound, in one case on the lower portion of the sore larynx itself. It required a great many applications of nitrate of silver, or subsulphate of iron, to destroy them; their disappearance would instantly relieve the symptoms and allow of the final removal of the tube from the trachea. Such is the case of the boy D'Echauffour, a patient of Dr. Hoeber's, for whom I performed the operation, at No. 67 Sixth Street, whose final recovery was long deferred by such new-formed granulations, and who is still said to suffer now and then from sudden attacks of dyspnœa, which (although I have not seen the child for some time) may still depend on the presence of small polypous excrescences, giving rise to obstruction or spasmodic contractions, when forced inspirations are taking place.

Not all of my operations were made on uncomplicated cases of laryngeal obstruction. In two, bronchitis had been diagnosticated in the incipient stages of croup, and almost all the cases, from 1859 to 1867, were complicated with local and general symptoms of diphtheria. Seldom have I operated on a case, without fever attending it from the beginning; seldom without the presence of swelling of the adjoining lymphatic glands. Those who have watched the prevalence of local diphtheria and general diphtheria in this city from 1858 up to this day, will feel satisfied that my statement is not exaggerated.

Now, while I admit that with symptoms of general diphtheria complicating a case of laryngeal diphtherite called membranous croup, the prognosis of the operation becomes more doubtful, I lay stress on the very same fact for the reason, that even in such cases, the only indication for the operation rests in the local obstruction. For it is easily understood, that while general diphtheritic poisoning with insufficient obstruction does not indicate tracheotomy; it is just as plain common sense that suffocation from obstruction of the larynx complicated with a constitutional

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affection, requires the only possible relief just as urgently as suffocation from obstruction of the larynx without such a complication. Seeing a person suspended by the neck and being strangled, we should hardly investigate into the propriety of cutting the rope from the point of view that the sufferer might be or is affected at the same time, with tuberculosis, carcinosis, or diabetes.

Still, there are other complications of croup which in the opinion of many authors have contraindicated the operation. Among these is bronchitis, and broncho-pneumonia, or other serious diseases. But among the number of my recoveries is the boy Rinaldo, of 94 Catherine Street, who had been suffering from bronchitis before the membranous obstruction of the larynx, resulting in imminent danger of life, with the usual symptoms, required tracheotomy, who developed bilateral pneumonia after the operation, and still got well; and the boy D'Echauffour, of 67 Sixth Street, who was taken with scarlatina, three days after the operation, and also recovered. I mention these facts to show that no regard and no prejudice ought to detain us from opening a new base of supply, when the original, normal one is cut off.

Death followed the operation, out of the 54 fatal cases, within 62 hours, in four cases; within 1 day in seven; on the 2d day in three; the 3d in eleven; the 4th in ten; the 5th in seven; the 6th in four; the 7th in one; the 9th in one; and the 18th in one.

The causes of death were the following:

Suffocation before the operation was finished, 1. It was the case of a girl of five years, hearty and robust; no difficulty in the performance of the operation until the incision into the trachea was made. Five cartilages being incised, I was astonished not to find the peculiar strong gushing sound of sudden respiration; so much the more I hurried to insert the tube, which after repeated attempts I found impossible. Thinking the trachea might be abnormally narrow, I tried to introduce the inner tube only; impossible. I then inserted an elastic catheter, but could not succeed in introducing it. Meanwhile, the child died. Fearing I had not opened the trachea at all, and pushed

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my instrument downward in front of the trachea in the loose cellular tissue, I removed the dilator and found the incision correct. I then forced a silver probe into the trachea, and felt some hard mass giving way after some pressure. The problem was then easily solved. The trachea and bronchi were densely filled with membrane, my incision had penetrated the trachea but not the membrane, thus my tube doubled the membrane inside the trachea, detaching it from its anterior wall; and thus, the child was strangled in the attempt to save her life.

Carbonic acid poisoning, asphyxia, 6. Operation performed too late.

Anæmia and exhaustion, 3.

General diphtheria, 8.

Bronchitis, 6.

Broncho-pneumonia, 15. Two of these died soon after the operation; one, a case of Dr. Blumenthal's, in which the diagnosis of the complication could not be made before the operation, in consequence of the laryngeal sounds covering the auscultatory symptoms belonging to the lungs, half an hour after the opening of the windpipe.

Bilateral croupous pneumonia, 1.

Broncho-pneumonia and gangrene of the lungs, 1. A girl of ten years, in 157 Eldridge Street, in whose neighborhood a large number of cases of diphtheria and croup occurred at that very time, 1864, showed the symptoms of general diphtheria on the first day after the operation. Every accidental sore on her skin became covered with diphtheritic membranes, and the wound assumed a fearful character. The diphtheritic necrosis of the tissue crept along the margin of the wound, along the intermuscular tissue, dissected as it were the single muscles, destroyed part of them and the whole of the surrounding cellular tissue, destroyed part of the cartilages until the tracheal wound was more than an inch in length, and one-third of an inch in width, so that the tube moved freely in the large aperture. On the fifth day extensive broncho-pneumonia, and on the eighth gangrene of the lungs commenced to show its fearful symptoms. The girl died on the thirteenth day.

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Uncomplicated pulmonary œdema (the case spoken of above). 1.

Suffocation from the membranous deposits extending into the smallest ramifications of the bronchi, 5. Four of them died on the third day; two exactly after sixty hours. One, a patient of Dr. Ranney's, on the fifth day. All of these cases did apparently well for some time, until the exudative process showed its presence far below. In some the process did not stop at all after the operation, but went gradually on. In some there was a complete rest, or intermission, and the chances very good indeed, thus in Dr. Ranney's case for three days. Then at once, the process would commence anew and not terminate until death.

Miliary tuberculosis, 1. A little girl had suffered from broncho-pneumonia some time previous; was reported to have recovered, but to have remained feeble. On the third day after the operation a violent fever set in, with general bronchitis. She died within thirty-six hours after. The post-mortem examination revealed an abscess half an inch in diameter in the upper lobe of the left lung, and cirrhosis of part of the same lobe, and miliary tuberculosis of recent date.

Exhaustion and pneumonia, 1. This was a very unfortunate case of the following description: A little girl of four years, a patient of Dr. Levings', appeared to do well after the operation, for some days. I commenced local cauterization of the larynx for the purpose of removing the membranes on the second day, and continued the same every day until the fifth. I held the solid stick of nitrate of silver by means of a forceps which I introduced into the trachea, end upward. With an unexpected movement of the child, I lost hold of the caustic, which fell downward and was not recovered. Incessant and violent coughing, day and night, with rare intermissions, was the next, pneumonia the final result. The child died on the ninth day. The post-mortem examination revealed no tracheitis, no bronchitis in the ramification of the first order, little injection in those of the second. A piece of nitrate of silver sticking to the inner side of the right

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large bronchus immediately imbedded in a thick albuminate, and not entirely obstructing the lumen. No injection in the neighborhood of the lining membrane. Old caseous infiltration by the hundred in the two upper, and the middle lobe of the right lung. A recent hepatization in the middle lobe of the right lung, and in the two lower lobes. Dr. Lothar Voss has placed at my disposal the statistics of his operations of tracheotomy performed for croup between 1853 and 1867. He has operated forty-three times, on twenty-three boys and twenty girls. Of the twenty-three boys, four recovered; of the twenty girls, six.

How much the prevalence of general diphtheria appears to have interfered with the results—a fact which has also been proved by my own experience, as I have no case of recovery for instance in 1865—is shown by the fact that of his six cases operated before the end of 1858, five recovered; while of the remaining thirty-seven operated upon between 1859 and 1867, but five recovered. Three of his cases were under two years, namely, 1 year 1 month, 1 year 8 months, 1 year 11 months, all of them girls, none of whom recovered. The only fatal case in 1858, the sixth of the number, was successful enough as far as tracheotomy itself is concerned, although it is counted among the unfavorable cases, the tube being removed on the ninth day. The child appeared quite well, but feeble. General and local diphtheria set in, of which and of the consecutive anæmia, the child died on the thirty-first day after the operation.

The ages of the children on whom Dr. Voss has operated are the following: 1 to 2 years, three cases; 2 to 3 years, fifteen; 3 to 4 years, ten; 4 to 5 years, eleven; 5 to 6 years, two; 6 to 7 years, one; and 7 to 8 years, one.

Of those who recovered, the age was 4 years 2 months; 4 years; 4 years 3 months; 3 years; 4 years; 2 years 4 months; 2 years 6 months; 2 years 6 months; 2 years 6 months; and 6 years 5 months.

In these ten cases the tube remained 8, 6, 8, 19, 14, 14, 8, 8, 5, 6 days. Some delay took place, usually, before the wound, which I, in my cases, have found to

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heal very fast, would close and remain so. Thus, a complete closure required in nine cases 18, 21, 19, 26, 25, 25, 30, 22, 17 days. On the tenth there is no record.

There are, besides, three cases which virtually belong to the recoveries, as far as the operation and its influence on the laryngeal obstruction is concerned. A child of 2 years 10 months was operated upon, the tube could be removed on the ninth day, but before perfect union of the wound had taken place, general diphtheria set in, and destroyed the patient on the thirty-first day; a child of 2 years 2 months had the tube removed on the seventh day, and died of bronchitis on the eighth; and a third one, of 5 years 2 months, after the tube had been removed on the eighth day, died on the sixteenth of pneumonia and consecutive pulmonary abscesses.

Death occurred, after the operation, in thirty cases, which have been accounted for: within twelve hours in five cases; within 1 day in three; 1 to 2 days in four; 2 to three days in five; 3 to 4 days in five; 5 days in two; 6 to 7 days in two; 10 days in one; 16 days in one; and 31 days in one.

And the causes of death are, according to the Doctor's account of thirty cases, the following: anæmia in one; convulsions in two; asphyxia in two; croup descending into the bronchial tubes, eighteen, (three of these were complicated with general diphtheria, two with convulsions;) emphysema in two; pneumonia in three, (two of which resulted in pulmonary abscesses;) bronchitis in one; and suffocation by accidental removal of tube in one.

Mr. Chairman, I hold in my hands, besides the statistics of my own sixty-seven and Dr. Voss's forty-five cases, a list of fifty-six cases of tracheotomy performed for croup by Dr. E. Krackowizer, our townsman. Of his fifty-six cases, fifty-five belong to this city, one to Europe (fatal). He operated on

23	in 1852-60,	with 5 recoveries,	and 18 deaths.
6	" 1861,	" 3	" 3
4	" 1862,	" 1	" 3
6	" 1863,	" 3	" 3
5	" 1864,	" 3	" 2

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6	in 1865,	with 1	recovery,	and	5	deaths.
2	" 1866,	"	-	"	2	"
3	" 1867,	"	-	"	3	"
<hr/>		<hr/>		<hr/>		
55		16		39		

The causes of death were croup and bronchitis, thirty; infectious diphtheria, three; scarlatina, one; tracheal granulations and attacks of dyspnœa, and exhaustion, 54 days after the operation, and 4 weeks after the wound healed, one; exhaustion and pulmonary œdema, four; suffocation during the operation, one. Total, forty.

I further, Mr. Chairman, in presenting this fourth list of statistics to you and the Society, desire to pay due homage to the memory of a deceased physician who is remembered by a number of those present, although over his accomplishments and expectations the grave has been closed these last ten years. Dr. Waldemar von Roth was the first among us who operated extensively for croup; and if he had no other merit to fall back upon, that would be sufficient that his memory should never die out from among both his professional brethren, and the public. Between August, 1852, and January, 1856, he operated on forty-eight cases, eleven of which recovered. Of the thirty boys 9, and of the eighteen girls 2, recovered. He records in 1852, six operations, and two recoveries; in 1853, eleven operations, and three recoveries; in 1854 sixteen operations, and two recoveries; in 1855, nine operations, and two recoveries; and in 1856, six operations, and two recoveries.

My last statements have been rather cursory, Mr. Chairman, as I have been afraid of taxing your patience too largely. I shall consider it my duty, as this subject has come up for consideration, to present all the statistics from which I have drawn to-night, to the medical public. What, however, my object has been, in speaking of a subject on which every one has obtained more or less knowledge, is clear. I meant to sift vague or misunderstood doctrines, to show that no harm is done by acknowledging the limits of our science and art, to prove that it is of more importance to know what cannot be accomplished

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by the internal administration of medicines than to fight an overpowering enemy with remedies, the number of which is surpassed only by their powerlessness, and finally, to state the results of tracheotomy in more than two hundred cases of croup, every one of which would, surely, have perished without it. Let those fifty doomed children saved by the operation, and let those whose sufferings were at least alleviated, plead before you the cause of tracheotomy.

CHOLERA INFANTUM

HEALTHY infants have a normal tendency to loose, liquid, or semi-liquid evacuations from the bowels. The cause of this looseness lies partly in the condition of the intestinal tract, and partly in the nature of the normal food, which is breast milk. Peristaltic movements in the healthy child are very active. The young blood-vessels and lymph ducts are very permeable, and the transformation of the surface cells is very rapid. In this way transudation from blood-vessels and the lymph bodies of the intestine is facilitated. The peripheral nerves are very superficial, more so than in the adult, whose mucous membrane and submucous tissue have undergone thickening both by normal development and morbid processes. In the young infant the peripheral ends of the nerves are longer in proportion than in the adult. The anterior horns in the nerve centres are more developed than the posterior ones. Moreover, through the defective development of the inhibitory centres, the reflex irritability of the young, particularly with regard to intestinal influences, is greater. Besides, the retentive action of the sphincter ani is not very powerful; the fæces are not retained in the colon and rectum, which is straight and adjacent to the steep infantile sacrum, and but little time is generally afforded for the reabsorption of the liquid part of the intestinal contents. All this illustrates the facility with which a moderate or even a copious elimination of liquid stools may take place.

Moreover, the frequency of acids, sometimes normal, in the small intestine, gives rise to the formation of alkaline salts with purgative properties. Hoppe-Seyler found free acids in the fæces in dogs and the human adult. Wegschneider met them in nurslings who received nothing but mother's milk. An explanation of this occurrence may be found in the fact that the quantity of food is often too

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large; but in many instances the amount of digestive fluid is too small, and thus fermentation is caused in place of normal digestion. Moreover, the diastatic effect of the pancreatic juice is limited at a very early age, and undigested material is carried off. In this way, the movements may become quite loose, without the occurrence of extensive or deep anatomical alterations. Superficial changes, however, may take place; they consist in the hyperæmia of the surface in rapid transmutation of epithelium, and the formation of mucus.

Most cases, however, of actual diarrhœa originate in excessive peristalsis, which may be either local or general. If it be limited to the small intestine exclusively, the contents retained in the colon may become dry, and the presence of hyperperistalsis in the former may then be doubtful. It may be caused firstly by irritation of local (intestinal) origin, or secondly by irritants furnished either by the nervous system or by the blood.

The first class embraces improper and indigestible foods, or excessive quantities. The abnormal composition of mother's milk is an occasional cause. Mothers who are sick, or convalescing, or subject to strong emotions, those who nurse too often, or suffer from tuberculosis or syphilis or anæmia, or are pregnant or menstruating, do or may secrete an anomalous milk. The colostrum secreted immediately after childbirth may cause diarrhœa; so may milk which contains too much either of fat, or casein, or sugar, or salts. It is mainly the casein, whose coagulation causes more intense disorders in the young than the causes leading to stercoraceous diarrhœa in the adult. An excess of fat is very irritating by the formation of acid. It is true that it is not the only element of perturbation in the usual food of the young, viz., milk. The milk sugar and albumin, as well as the fat, may give rise to the development of acids. In that respect the albuminoids (casein principally) are not very injurious, even milk sugar is but moderately so; but as the oxidizing power is greatly reduced in gastrointestinal disorders, the products of the decomposition of fat are very active. Together with fat acids, carbonic acid and sulphide of hydrogen are formed.

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Their irritating effect may give rise to hypersecretion, only, but frequently leads to catarrh. A similar effect is caused by purgatives, mainly by salts either medicinal or contained in fruit or certain abnormal milks. Parasites act similarly, from lumbricoids to trichomonads or amœbæ. It is true that when present they have not always caused the liquid stools in which they are found—indeed, in a case lately observed of intestinal ulceration of long duration trichomonads were not found for months, until at last they appeared in incredible numbers, thus suggesting that it was the abnormal condition of the intestine and of its contents which facilitated their existence, and not vice versa. But the occasional improvement of diarrhoeal diseases after the removal of such parasites allows of but little doubt that they may be the actual cause of the liquid and offensive stools in which they are found.

The intestines may be irritated by changes of innervation, less, it is true, in infants and children than in adults. Experiments on the pneumogastric, sympathetic, and splanchnic nerves have furnished ample proofs of their influence on intestinal secretion and peristalsis, but it is mainly clinical observation which has established its existence. Trousseau discoursed extensively on nervous diarrhoea. The gastric and intestinal crises of *tabes dorsalis* are frequent occurrences. Beard quoted both constipation and diarrhoea among the symptoms of neurasthenia; Möbius claims the same for migraine; the action of tobacco is of daily experience. Nor is it out of place to remember the influence of rapid changes of temperature among the most frequent causes of diarrhoea, in all seasons, and for all ages. Thus the prevalence of bacteria and toxins in our etiological reasonings should not be able to dislodge reflex hyperæmia and secretion from their correct places as causes of disease. Like the nasal mucous membranes, the intestinal surface is profoundly and suddenly influenced by colds. Wet feet and exposure of the perspiring skin to a cold or draught will convince the most obstinate and exclusive claimant of bacterial rights of his dependence on other external factors.

Intestinal irritation, with peristalsis and hypersecretion,

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is often caused by changes in the blood. Pilocarpine, or salines and other purgatives injected under the skin cause diarrhœa. So does uræmia, sometimes without any anatomical alterations of the pale mucous membrane, other times with catarrhal, ulcerous, or croupous changes depending on the action of ammonium carbonate. Extensive burns of the surface of the body exhibit similar results. They are also observed in malarial poisoning. Infections, such as those in lobar pneumonia, influenza, erysipelas, and septicæmia, may cause intense diarrhœa, with or without visible alterations. Even typhoid fever may give rise to extensive transudations without either catarrh or ulcerations of the mucous membranes. That is mainly so in a certain number of young patients, in whom Peyer's plaques are but slightly developed and but slightly changed. Hødenpyl's latest researches prove that even without glandular changes typhoid fever may exhibit all sorts of typhoid symptoms. Asiatic cholera, finally, by its toxin, which is absorbed and reaches the intestinal glands, results by hypersecretion and failing absorption, in very copious discharges. We shall see that cholera infantum exhibits the same symptoms.

SYMPTOMS.

Cholera infantum may be preceded by symptoms of gastric or intestinal, or gastrointestinal catarrh, but is frequently ushered in without any prodromi. Vomiting and diarrhœa, often diarrhœa without vomiting, with either a moderate or a high elevation of temperature, are the first symptoms. Vomiting follows the ingestion of food or drink immediately, and may be continued without this cause. In the latter case nothing but mucus and a serous fluid, later bile, are brought up; the latter in small quantity, until its secretion and elimination stop altogether. The alvine discharges are copious and numerous, from half a dozen to two dozen a day. They are acrid at first, alkaline afterwards, and watery. They contain no bile but large masses of intestinal epithelia and bacteria. The abdomen is soft. The thirst is intense, the pulse small and frequent, the voice hoarse or gone, the fontanelle depressed, the skin

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cool and inelastic to such an extent that it can be raised in folds. At this time the temperature of the cavities, if it was high at all, sinks to or below its normal level. The cornea becomes turbid, respiration difficult, and general collapse sets in. The rapid loss of water from the circulation results in anuria and in thickening of the blood, by which are caused cerebral symptoms depending on the slowness of intracranial circulation, or on actual thrombosis. Listlessness with exhaustion, and convulsions when occurring from these sources are called hydroencephaloid. They are complicated with those caused by uræmia, which originates in the absence of renal secretion. The latter does not depend, however, on the copious loss of liquid through intestinal oversecretion alone, but also on actual nephritis, which is recognized by the presence of red blood cells and leucocytes, and of hyaline, epithelial, and granular casts in the small amount of urine either spontaneously evacuated or secured by catheterization. If the patients live long enough, they develop in the lower extremities sclerema which has the tendency to ascend slowly. Chronic cases, or those which turn to a slow recovery, are also apt to cause furunculosis of long duration, with frequent relapses, great suffering, and possibly change into actual septicopyæmia. Pneumonia, pleurisy, peritonitis, and meningitis may follow. They may be the results of thrombosis, or of the original microbic infection which need not, and seldom does, limit itself to the intestinal tract. Altogether the symptoms of the different stages of cholera infantum are explained in two ways, either by the direct intoxication, or by the abstraction of fluids from the organism.

COMPLICATIONS

One of the most interesting complications or sequelæ of cholera infantum, indeed of all such intestinal disorders as present or furnish toxins, is that with renal derangement or disease. Like the liver, the kidneys—while their tissues are normal—eliminate microbes from the blood (Biedl and Kraus).¹ This process is increased by diuresis, an observation which is of considerable value for therapeutics.

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The first functional change is albuminuria. It may be of no account even when it is cyclical, and when it makes its appearance only when the patients are out of bed, and differs greatly in its import from the formation of casts which depend on morbid processes either in the secreting epithelium or in the intercellular substance. Genuine nephritis, either parenchymatous or intercellular, occasionally with shrinking, with hemorrhage, rarely amyloid, and seldom exhibiting dropsy, retinitis, vascular tension or cardiac hypertrophy, is a very frequent result of intestinal toxicity. In a small hospital containing little more than forty beds, I noticed lately at the same time four cases of nephritis evolving out of and accompanying protracted colitis.

PATHOLOGICAL ANATOMY

When the disease has lasted only twenty-four hours there may be few or no changes in the gastrointestinal mucous membrane. When it has lasted longer, the mucous surface is deprived of its epithelium (under the influence of excessive fermentation and secretion brought about by toxins, nerve influence, or ingesta). Between the gastric glands round cells are deposited in large numbers in the mucous membrane of the stomach. The gland cells are swollen, and according to Fischl and Heubner² their nuclei are stainable only with great difficulty. The same round-cell proliferation takes place in the lower parts of the intestinal tract; here also the epithelium of the villi is thrown off. The blood-vessels are dilated and filled with blood. Lieberkühn's glands are rarely intact; they exhibit funnel-like dilatations and an increase of cells, which is also manifest in other glands. Peyer's plaques, too, are large and rich in newly formed cells, which are also found between the muscles. Microbes are met with in large numbers and in many varieties. *Bacterium lactis aërogenes* mostly in the upper part of the bowels, and *B. coli commune* mostly in the colon, are common. Among them there are streptococci and liquefying bacilli which are inconstant though frequent in all sorts of diarrhoea. So far as *bacterium coli commune* is concerned, it was discovered by

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Escherich in 1885. At that time it was considered to be harmless. But in 1889 it was found by Larnette in two cases of perforation peritonitis; its cultures caused experimental peritonitis in animals. Since that time it has been met with in many tissues of the human body, into which it has emigrated during the moribund state or after death; but it appears also to be settled that it may cause inflammation, suppuration, and sepsis in many diseases, such as enteritis, colitis, typhlitis, peritonitis, cystitis, pyelonephritis, cholecystitis, meningitis, angina, pneumonia, endocarditis, arthritis, salpingitis, endometritis, lymphangitis, pararitium, gas phlegmon, and puerperal fever. Lately a case of peri- and endometritis was published by Uhlenhuth,³ who claims that in his patient the bacterium coli exhibited three different degrees of virulence.

Like Escherich, Booker found no specific bacteria in diarrhoeas, but mixtures of many; proteus vulgaris was mostly found in the colon, also in the stomach, least in the small intestines. When streptococci are extensively met with, they give rise to symptoms resembling an irregular typhoid fever, and depending either on streptococcal infection or on the absorption of a toxin. All of them are or may be the causes of the palpable changes in the intestinal surface; when they are severe and lead to ulceration, microbes may be swept into the circulation. In this way the lungs are known to be infected. Still it should here be emphasized that intestinal ulceration does not always require the presence and action of bacteria to any or to such a degree as in diphtheritic or gangrenous colitis, where they are mostly in evidence.

The contents of the bowels are copious and thin, exactly like those which are observed in children who have died of convulsions during the hot season. In sunstroke both the stomach and the intestines are apt to be found in the same condition. This similarity is very suggestive. It appears to show that cholera infantum, when fatal on the first day, proves so by paralysis exactly as in insolation. At that early time surely cholera infantum is not yet enteritis. This is primary in the other forms of intestinal oversecretions; in cholera infantum it is secondary. The kid-

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neys are large and pale, with fatty degeneration of the parenchyma, and sometimes pus in papillæ and calyces. Bacterial emboli are rare, certainly much rarer than in the lungs. The liver shows the same cloudy swelling of the parenchyma which is met with in the kidneys. Other pathological changes are the intense rigor mortis, and the dark color and defective coagulability of the blood. The meninges and the lower part of the lungs are hyperæmic.

These results were partly found, and partly confirmed by one of the most industrious and careful of modern bacteriologists who at the same time is a clinician, Booker, who spent years of labor on his researches on the bacterial nature or complications of the different forms of intestinal disorders, both light and grave. He published ninety-two bacteriological examinations, in all of which he found the bacterium lactis aërogenes and coli commune; in most of them also streptococci and proteus vulgaris. The number of his autopsies was thirty-three; the cases were classed by him as acute and chronic gastroenteritis. In the former the local alterations of the intestine were but few; but the general infection, including that of the lungs in which bacteria were found, and that of the spleen and kidneys which were mostly affected by toxins, was very intense. The later exhibited many alterations both of an inflammatory and a degenerative nature, which differed with the localization and the destructive influence of the bacteria. When he met with these same results in the living, the prognosis depended on the clinical symptoms, which differed widely in individual cases. This observation of a pathologist who is at the same time a clinician proves again the insufficiency of pathological anatomy when confined to the dead-house, or of bedside observation when not guided by histological and bacteriological research.

The ubiquitous appearance of a great many varieties of microbes which were present in all sorts and grades of intestinal disorders, induced Booker to venture upon a classification which is partly clinical, and partly bacteriological. He distinguishes three forms of diarrhœal diseases: (*First*) The dyspeptic diarrhœa, with no inflammation, with no leucocytes or epithelia in the lumpy acid stools, with plenty

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of bacteria coli communia, and few specimens of bacterium lactis aërogenes. This is sometimes an independent form, but other times the first stage of (*second*) the streptococcic gastroenteritis. This has the character of a general infection, the intestines are ulcerated or suppurating, the stools contain mucus, leucocytes, and streptococci. These are sometimes very numerous, in some instances mixed with bacteria coli communia. When cocci are prevalent, the cases are very obstinate and fatal. Booker's *third* form is a bacillary gastroenteritis. It exhibits less local inflammation than intense toxæmia. A great many varieties of bacilli are found, with or without streptococci. Not one of these three classes, however, is claimed as a clinical or pathological entity; on the contrary, *transitions* between them are pronounced to be very frequent.⁴

After all, observers agree in the absence of a constant and pathognomonic microbe. Among others, Baginsky and Stadthagen found a body (probably basic) in the cultures of a bacillus from cholera infantum which is probably identical with one obtained by Brieger in decomposing horseflesh, that is very poisonous, acts on frogs like curare, dilates the pupils, and stops the heart in diastole.

ETIOLOGY

The theories established for the explanation of cholera infantum changed with those governing etiology in general. Fifty years ago almost all the diseases of the infant, and some of the mother, were traced back by Thomas Ballard to "fruitless sucking." Infant cholera was by some considered identical with Asiatic cholera. Some unknown atmospheric influence, sewer emanations of undescribed nature, evaporations of the upper strata of the earth, malaria, moisture, the oscillations of the barometer, or of the subsoil water were charged with being the causes of cholera infantum, with equal and positive fervor.

When etiology became more bacteriological, microbes were accused, for instance, those of the genus *ascophora*, by Bouchut; others looked for poisons, as Sonnenberger, for the presence in the food of plant alkaloids.

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The temptation to attribute cholera infantum to the direct influence of microbes was combated by the fact that too many of the latter were found, and that it became difficult to identify a single one as the cause of cholera infantum. Neither Escherich nor Baginsky nor Booker convinced himself that there was a direct connection between the presence of special bacteria with the symptoms of cholera infantum. Baginsky found twenty species or varieties of bacteria, mostly saprogenous, none of which could be claimed as pathogenous. Thus chemistry, after having long been neglected, had to be called in. Uffelmann and Seibert accused the decomposed milk sold in large cities, Lesage a poison produced by some microbe not specific, Vaughan his tyrotoxican. The poisonous substance would, in the opinion of many of these authors, be evolved out of milk, even out of breast milk. Difference of opinion, however, became apparent in regard to the question whether the poison entered ready made with the milk, or was developed out of it in the alimentary tract of the infant. Both of these opinions are founded on facts; in many cases both roads were found accessible to the poison.

The first stages of cholera infantum do not look alike. Some cases begin very abruptly, others have a slight gastrointestinal disturbance or prodrome. The patients are less than two years old. In the vast majority the feeding is artificial, and with but few exceptions the attacks occur during the hot months of the summer, on such days as furnish only a slight difference between the temperatures of day and night, and during the weeks following them.

Constant heat is undoubtedly a prominent etiological factor. It appears, however, that when and where the babies are habituated to a warm climate, they do not suffer like those who are suddenly exposed to excessive temperatures. The differences of temperature, as collated by Meinert, between January and July, are in Africa 3.4° C. (6.1° F.), in South America 4.2° (7.5° F.), in Australia 13° (23.4° F.), in central Asia and Europe 26.1° (47° F.), and in North America 28.4° C. (51.1° F.). The sudden heats of the temperate zones are among the prin-

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cial causes of cholera infantum; in them it is most frequent, though it be found in warm climates.

How does heat affect the babies, indirectly or directly? Its indirect effect is best appreciated when it is remembered that breast-fed babies do not suffer like those artificially fed. Meinert's observations in Dresden⁵ yielded eighteen deaths among the former, four hundred and sixty among the latter in eleven hot summer weeks. This agrees with what every practitioner learns from his own experience. That coarse and fermentable food leads to catarrhal irritation of the intestine which may precede cholera infantum, or to the formation of a toxin or toxins which cause it without a previous anatomical lesion, is easily understood.

Is there anything like a direct influence of heat on the baby with the result of causing cholera infantum? It has always appeared so to me. In a brief paper read before the Verein Deutscher Aerzte in 1858—it is contained in the minutes of the society—I took that stand; and again in 1868 in a paper⁶ entitled "Concerning the Neglected Causes of Infant Mortality in the City of New York." Twenty years ago Clark Miller⁷ pointed out the striking resemblance between cholera infantum and sunstroke. He claimed the symptoms belonging to the former as due to paralysis. Meinert shares his opinion to its full extent.

Both are disease of the hot season, and caused by uninterrupted heat. Hot days relieved by cool nights are well tolerated; it is the constant heat which proves detrimental. Constancy is still more dangerous than temporary excess. A relatively lower temperature, but relentless and moist, demands most victims. High temperatures with wind and drought are comparatively safe; absence of ventilation is destructive. No wall ventilation takes place during summer; and in the first weeks of the autumn the houses remain warmer than the surrounding air, for the soil retains the temperatures soaked in during the summer. All this is worse in large cities, in crowded streets, where the buildings are high and exclude wind and draught, in narrow flats or tenement houses, in residences with scanty windows looking in one direction only. In them the

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babies are housed, there they are stifled in their beds. If they be breast fed, they are now and then taken up and changed about. If not, they are given their bottles in their cribs without perhaps changing their positions. Lehmann experimented on such babies buried in their beds, and found that they inhale four times the amount of carbonic acid received by those not so buried. They are the ones that are liable to suffer, though or rather because they are not exposed to the sun, from isolation; they are the very victims of cholera infantum. For in addition they lack what is most essential to keeping up circulation and tissue metamorphosis, viz., water. Sweltering in their unclean and hot bed prisons they are given the exact food they receive on cool days. The very adults who will satisfy their thirst by copious draughts of water, will never think of giving an extra allowance of it to their starving young ones. The breast-fed infant is better off in that respect also. The mother or nurse, drinking *ad libitum*, dilutes her milk, for breast-milk is no unchangeable article like the Gordon-Walker or Gaertner; it may change in certain limits its percentage of constituents every hour of the day, every day of the week.

The question whether heat causes cholera infantum by its direct or indirect effects is therefore easily answered. It acts in both ways. By fermenting and spoiling the baby's food, mainly cow's milk, it produces deleterious ptomains. By paralyzing its nervous system it causes the characteristic gastric and intestinal disturbances, oversecretion and non-absorption. Both of these need not coincide with, or depend on, catarrhal or other changes of the alimentary tract. But these latter will become apparent when the former have lasted more than a day.

No single cause will always have a uniform effect. Individual power of resistance and vitality increase or lessen the action of external circumstances. A certain predisposition is always required to make a living being submit to a morbid influence. Not everybody suffers from insolation when exposed to protracted heat. Nor is the same food equally dangerous to all. In the foundling hospital of Prague, under Epstein's control, the mortality of the

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infants is excessive; that of the same class of infants when sent to the country and fed on the same material, is comparatively trifling. In a small ward of a hospital or in a private room of a poorly equipped residence the mortality of infants is not so great as in large wards or big institutions. When thirty years ago I proved that in such a one every infant that was kept a few short months died, I was expelled for my pains. Still the fact remains exactly so. One of the most assiduous and learned pediatricists of modern times, Heubner, had the same experience. He expects the little waifs in his hospital to live only when he is able to transfer them to the country, or to their own poverty-stricken homes. Thus not even better hereditary influence, or constitution, or previous good condition are safeguards; and bad food alone is not the only detriment.

It should not be forgotten that in many cases the fatal intestinal disorder is of microbic origin, or is readily becoming complicated with microbes and their toxins. They are contagious. There is no hospital or nursery ward without them. The clothing and bedding are soiled, the nurses stain their fingers with it, and going from one baby to the other, feeding, washing, changing clothes, infect one after the other from a single source. Infection of the intestinal tract takes place not only through the mouth but also through the anus. This source of infection is almost unavoidable. Heubner succeeded in reducing his mortality by more than twenty per cent. by simply employing a set of nurses for the exclusive duty of attending to the diapers, and another set for feeding and other attendance. As long as a single nurse has the whole attendance on a number of infants, absolute cleanliness of her fingers is practically an impossibility. If in every such institution the mother could be kept with her infant, the danger of contagion would be relatively small.

DIAGNOSIS

The diagnosis of "cholera infantum" becomes difficult only in those cases which have developed out of catarrhal conditions of the alimentary tract under the same in-

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fluences which give rise to all sorts of disturbances, viz., constant solar heat and inappropriate feeding. For the purposes of practice an exact diagnosis in difficult cases is perhaps not always very important. For no matter what the case may be called, the indications presented by the local changes in the alimentary tract and by the constitutional symptoms exhibited by the patients are more or less identical. Still the diagnosis of "cholera infantum" from other forms of gastrointestinal disturbances should be made; in many of the latter the successful treatment depends on the exact knowledge of the condition of the bowels. There are several forms of diarrhœa which should be known in this connection, viz., fat diarrhœa, catarrhal enteritis, and follicular enteritis.

The name of "*fat diarrhœa*" was given by Biedert to a condition in which the normal proportion of fat in the infant fæces, which amounts to from four to twenty-five, mostly from nine to eleven per cent., is increased to from forty-one to sixty-seven per cent. In this form of diarrhœa the discharges are shining and glossy with fat of yellowish or gray color, sometimes greenish, mixed with mucus, and mostly very malodorous. The fat molecules are large, in the normal fæces small. It should be remembered, however, that the percentage of fæcal fat is liable to be increased in every attack of dyspepsia (Tschernow, Uffelman).

This fat diarrhœa may be primary or secondary. The first is the direct result of the ingestion of an excess of fat, and is relieved by correcting the composition of the food. Fat should be diminished, and sometimes withheld altogether. For some days the substitution of egg water (albumen beaten up in water or in barley or toast water), or of a thin chicken broth is advisable. There are some babies who from the moment of birth bear milk, even breast milk, in great dilution only—an illustration of the justice of my demand of ample dilution of the food given to the newly-born and very young.

The secondary form of fat diarrhœa, not depending solely on an excess of fat, is due to catarrhal conditions of the intestine, or to disease of the pancreas. In autop-

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sies duodenal catarrh, a large size and dry condition of the pancreas, a contraction of the orifice of the choledochus and pancreatic ducts, parenchymatous pancreatitis and fatty degeneration of the liver have been found. A moderate amount of the latter, however, is met with under normal conditions of the baby.

In *intestinal catarrh* (catarrhal enteritis) there are fever, diarrhœa, and pain, and when the affection begins in the stomach, vomiting also. The babes are pale, and draw up their legs, and when the catarrh descends to, or begins in, the rectum, there is tenesmus. The evacuations in the beginning contain remnants of food, and have a stronger odor than normal fæces, still they are not very offensive; afterwards they are liquid, light yellowish or brownish in color, strongly acid, but later of an alkaline reaction, with many specimens of bacteria (none of which is characteristic of the affection), epithelium, mucus, sometimes pus, and remnants of food of all kinds; the percentage of water is very large, amounting to ninety to ninety-five per cent., while in normal fæces of the nursing it is but eighty-five per cent., and in older children eighty to seventy-five per cent.; particularly is the percentage of water large in all those cases of diarrhœa which depend upon, or are complicated with, disturbances of the circulation brought on by diseases of the heart, the lungs, or the liver. If the evacuations were first odorless, they become fæcal, afterwards acid, and in protracted cases and so-called follicular enteritis, cadaveric.

In the beginning of the disease there is sometimes herpes labialis, and the urine is diminished in quantity, but is entirely arrested only in the very worst cases which have a tendency to become choleraic. In a few cases recovery is quite rapid; in others the disease terminates in so-called follicular enteritis, or in chronic intestinal catarrh.

When there is diarrhœa we have to conclude that the upper part at least of the colon is affected. Food remnants will require two or three hours to pass from the pylorus to the cæcum; until then the contents are fluid. Below that point they become rather dry; not so when part of the colon is also in a catarrhal condition. Thus, when they

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are quite fluid, an affection of the upper part of the colon necessarily exists and results in undue peristalsis.

Duodenal catarrh can be diagnosed only when it is complicated with jaundice, as, when uncomplicated, it never gives rise to diarrhoea. Catarrh of the jejunum and ileum is seldom isolated without the upper part of the colon participating in the process, and it must be supposed that they are disordered when the stomach is affected in a case of diarrhoea. When the fæces are fairly solid and contain conglomerate masses of mucus thoroughly mixed with the fæcal masses, we make the diagnosis of isolated catarrh of the small intestine. Further, when the fæces contain a great deal of undigested material we may also conclude that we have to deal with a complicated catarrh, involving both the small intestine and stomach; this is the condition in which undigested food is seen in the fæces ("*lientery*"). But it must be remembered that gastric catarrh alone, with anæmia and abnormal peristalsis of the stomach and upper part of the small intestine, is of itself able to propel undigested food with abnormal rapidity.

When there is bile in passages of green color, yielding a distinct reaction with nitric acid, and attached to the mucus and cylindrical epithelium and round cells, we have also to conclude that the catarrh has its seat in the small intestine, as under normal conditions there is but very little or no bile in the large intestine.

It has been stated that when there is considerable peristalsis and rumbling (audible or perceptible on palpation) in the middle of the abdomen and its lower part, the affection is in the small intestine; that they are lateral and in the upper part, when the large intestine is involved. Still, neither pain nor locality is absolutely pathognomonic. There is one condition, however, that is so. When the mucus is not thoroughly mixed with the fæces, when the fæces are wrapped up in or covered by it after evacuation, then the mucus comes from the colon, and we have to deal with catarrh of this part of the intestine; and when the fæces are still solid, the catarrh has its location in the lower part of the colon.

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As a general rule, acute catarrh of the lower part of the colon generally furnishes pure mucus mixed with blood, particularly in the catarrhal form of dysentery. When the secretion from the colon is very considerable, the bowels are evacuated more or less frequently, in large quantities or smaller ones, suddenly and with a gush, and usually without tenesmus, which is observed only when the lower portion of the rectum is involved in the morbid process.

In *follicular enteritis* the pathological changes are those of catarrh, but the most severe alterations take place in the solitary follicles and in Peyer's patches. Both of these are enlarged and prominent, and grayish or grayish-red, the latter surrounded by a red zone; now and then ulcerations are found. The microscope also reveals a large number of newly formed round cells, disintegrated or not. In the ulcerations there are large masses of detritus and bacteria. The lymph vessels and lymph bodies participate in every severe form of intestinal catarrh, and there is a large amount of acute and chronic tumefaction of the mesenteric glands.

The symptoms vary according to whether this particular form is connected with acute or chronic intestinal catarrh. In the first variety there are fever and diarrhœa, frequent and copious discharges, all accompanied by pain; the inclination to evacuate the bowels is constant, and there is some tenesmus. When the latter is present, the passages are small, greenish, foamy, have an insipid, musty, and after a while cadaveric odor, are covered with mucus, some blood and pus; actual hemorrhage is rare. Under the microscope are seen mucus, blood, pus, and round cells, unchanged or undergoing disintegration, and bacilli and zoöglœa.

The symptoms are liable to increase very rapidly, and complications with pulmonary diseases and peritonitis are not infrequent. Although the disease is a very serious one, slow recovery may take place.

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PROPHYLAXIS

There are many measures of a public character that would, and could, be taken in the interest of prevention of cholera infantum and all other intestinal diseases in a more advanced condition of public hygiene. The demand for more air space to the individual, for the separation of, and less stories in tenement houses, for protection against the sun in our streets, for extensive street sprinkling, for street cleaning, for an abundance of large and small parks and covered piers, for public baths reserved for infants and children, for a close and strict supervision of our markets by the health departments, will be complied with in some distant future when human society and the state recognizes their responsibilities to the individual in contradistinction to the egotism and individualism of the present. Indeed many questions of the public hygiene and welfare are of a social and politico-economic nature only; and the safety of the individual depends on the sense of responsibility demonstrated by the state through its laws and institutions established and managed in the interest of all.

Private houses and rooms should be kept cool in summer and well ventilated. Our windows, which can never be opened more than half, are badly arranged. If a prize had been set on faulty construction it would have been awarded to the man who devised our present arrangements for light and air. The dwellings in the tenements of the poor, with windows on one side only, with an impossibility of procuring a draught, are the main sufferers from these windows of which the upper half only can be lowered or the lower half raised.

No weaning should ever take place in summer, except for very urgent reasons, and with the possibility of procuring good substitutes, inclusive of fresh or aseptic milk. To this the most careful attention should be given. No family should be without red and blue litmus paper, to make sure of the absence of acidity. Altogether the rules which have been published by the Health Department of this city these thirty years, with but slight modifications

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of and additions to my original draft of 1866, have proved useful and successful.* Diarrhœas must not be neglected. Diarrhœa from "teething," if it existed at all, should not be overlooked any more than that depending on its usual causes.

NORMAL FEEDING

The most important preventive of cholera infantum (as of other intestinal diseases or disorders) is appropriate and digestible food; in the vast majority of cases this is, for the poor infant, human milk. Whenever that cannot be had, proper substitutes should be provided. Among them the milk of the goat and that of the cow take the highest rank. The former, however, contains too much

* The original draft of those rules, which was but slightly altered afterwards, was as follows:

If you nurse your baby:

Do not nurse your baby oftener than once every two or three hours.

Do not nurse a baby of more than six months oftener than five times in twenty-four hours. When it is thirsty in the mean time, give it cold water. In very hot weather only, mix a teaspoonful of whiskey with a tumblerful of water.

If you cannot nurse your baby:

You cannot bring it up without milk. But the milk (cow's milk) must not be given pure, nor with water.

Boil a teaspoonful of barley, ground in the coffee-mill, with a gill of water and a little salt for fifteen minutes, then add half as much boiled milk and a lump of loaf sugar, and give it luke-warm from a nursing-bottle.

Bottle and mouthpiece are always to be kept in water when not in use.

Babies of five or six months, half barley water and half boiled milk, with salt and loaf sugar.

When the bowels are costive, take farina instead of barley flour.

When they are very costive, take oatmeal gruel; strain it before mixing with milk.

When you have but half enough breast-milk use the same food. Give the food and breast-milk alternately so that your milk has time to get fit for your baby to take.

You may give beef tea or beef soup mixed with your barley or

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casein and fat, besides being otherwise incongruous. From many of my writings, and mainly from the second edition of my "Therapeutics of Infancy and Childhood" I here condense the following points:

The mixed milk of a dairy is preferable to that of one cow. Cow's milk should be boiled before being used. Condensed milk is not a uniform article, and its use is precarious for that and other reasons. Skimmed milk obtained in the usual way, by allowing the cream to rise in the course of time, is mostly objectionable, because such milk is often acidulated. The caseins of cow's and woman's milk differ both chemically and physiologically. The former is less digestible. There ought to be no more than one per cent. of casein in every infant food. Dilution with water alone may appear to be harmless in many instances, for some children thrive on it. More, however, appear only to do so, for increasing weight and obesity are not synonymous with health and strength. A better way to dilute cow's milk, and at the same time to render its casein less liable to coagulate in large lumps, is the addition of decoctions of cereals. Their mechanical effect, however, is not the only one which is obtained. They add to the nutritiousness of the food by their albuminoids, and are certainly not injurious because of their relatively small percentage of starch, for from the very first month of life a distinct diastatic effect is produced by the oral secretion; it increases with every month. Even infusions of the parotids, prepared at different times after death, farina or gruel to babies of five months and older. When ten or twelve months old, a piece of rare beefsteak every day to suck on.

No child under two years ought to eat from your table.

Summer complaint:

When babies throw off and purge, give nothing to eat and nothing to drink for at least four or six hours. After that you give a few drops of whiskey in a teaspoonful of ice water now and then, but *no more* until you have seen the doctor.

Stop giving milk at once.

Give no laudanum, no paregoric, no soothing syrups, no teas.

When you see the doctor, trust in him and not in the women. They do not know better than you do yourself.

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produce the same effect. Infusions, however, of the pancreas taken from the bodies of infants who have lived three weeks produce no such changes. The diastatic power of the pancreas begins with the fourth week only, and remains feeble up to the end of the first year. Krüger (1891) found in the fœtus of seven months a sugar-forming ferment which increases towards the normal end of intrauterine life, is still small in quantity at birth, but then grows so rapidly that it is as active about the eleventh month of life as it is in the adult.

Zweifel experimented with infusions of different glands. That of the submaxillary glands of an infant did not transform starch into sugar, even after the lapse of a whole hour. The effect of an infusion of the parotid of a baby seven days old was distinct after four minutes; however, that of the parotid of a baby who had died at the age of eighteen days, of gastroenteritis, did not act until the lapse of three-quarters of an hour. Nor was a diastatic result obtained by a similar infusion made of the parotids of a baby prematurely born, and of one who died of diarrhœa and debility.

In the healthy baby, however, that diastatic effect is not absent. In connection with this fact it is also important to know that the effect produced by saliva persists in the stomach for a period of from one-half to two hours. But this ceases, and starch will no longer be changed into grape-sugar inside the stomach, as soon as the secretion of hydrochloric acid has begun in the digestive process. This is a very important fact, because it shows that the farinaceous food of the infant or child, though it be not masticated and pass the mouth very rapidly, is in the stomach still under the influence of the saliva. For hydrochloric acid is not secreted at once. The first acids in the stomach while digestion is going on are organic, mostly lactic. This is found to be contained in that organ when gastric juice is removed from it in the first period of digestion. Thus in a gastrostomized boy Uffelmann found under normal circumstances, during the first half-hour, lactic acid only; afterwards hydrochloric acid. The latter is not met with during fevers of any kind, provided the

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temperature is high, nor during a severe gastric catarrh (nor in dilatation of the stomach resulting from congenital or other constriction of the pylorus). In these conditions farinacea (amylacea) are taken to advantage, principally because the diastatic effect of saliva is not disturbed.

In anæmia and in convalescence, particularly from fevers, the functions of the stomach are impaired. In them both pepsin and hydrochloric acid are wanting. To increase their secretion large quantities of *water* are required.

Infants' food ought to be mixed with large quantities of water, not for the sick only, but under ordinary circumstances. In diseased conditions of the stomach the free dilution of children's nourishment with water is demanded upon the following additional facts. Only to a certain limit, if at all, will pepsin be furnished for digestive purposes. Probably a portion of this is not entirely utilized, because a great quantity of water is necessary to assist in pepsin digestion. In artificial digestion albumin often remains unchanged until large quantities of acidulated water are supplied. Without doubt many disturbances of digestion are to be explained by a deficiency of water, certainly many more than are due to an excess of it, for the latter is speedily relieved by rapid absorption.

When metamorphosis is generally slow, water in abundance increases the elimination of urea and carbonic acid. When the urine is scanty and of too high specific gravity, water protects the kidneys from undue irritation. It acts on the mucous membranes as it does on the external integuments. In laryngitis and bronchitis it liquefies viscid expectoration; in many forms of constipation it acts beneficially by increasing the secretion of the muciparous glands of the intestines. Ice and ice-water, or iced carbonated water, in small quantities, but frequent doses, relieve hyperæsthesia of the stomach and stop vomiting. Another regular addition to the milk food of infants and children should be that of *sugar*. Its percentage in the milk of the woman is larger than in that of the cow. Immediately after the milking of the cow the milk-sugar begins to be changed into lactic acid. This process, after the rennet of the stomach has exerted its coagulating effect, together with

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the gradual conversion of fat into acid, is the final cause of curdling. The large amount of sugar in woman's milk, together with its smaller percentage of casein (about one per cent.) and butter, gives it the peculiar bluish color and gives to the colostrum of the first days after birth (it contains plenty of salts besides), its tendency to loosen the bowels. This property becomes manifest, sometimes under abnormal circumstances. Thus in the milk of anæmic women sugar is occasionally found to an unusual degree. In their cases the other solid matters may also be diminished, still this is not uniformly so. The infants, however, suffer often from obstinate diarrhœa.

The conversion of milk-sugar into lactic acid takes place very rapidly. Under its influence cow's milk turns sour at once. Not infrequently is it acid from the first; it has been found to be so in the udder; in most cases it is "amphoteric," neutral. Thus the question arises what kind of sugar is to be used as the addition to the food of children both well and sick.

Cane-sugar is not so easily transformed. Indeed, it is utilized for the purpose of counteracting the rapid conversion of milk-sugar, and for the preservation of articles of food in general. Trade is not so slow in availing itself of the results of organic chemistry as the medical profession. Condensed milk remains unchanged a long time, on account of the plentiful addition of cane-sugar, in spite of the original presence of milk-sugar in it. Therefore it is not at all an indifferent matter whether milk-sugar or cane-sugar be added to the food of infants and children. I have always insisted upon the selection of the latter for that purpose. Biedert employs cane-sugar in his cream mixture.

In the sick the absorption of sugar is slower than in the healthy. Besides, during most diseases, particularly those of the alimentary canal, there is more abnormal ferment in the mouth and stomach. Thus but little sugar ought to be given, and never in a concentrated form. Grape-sugar and dextrin are absorbed equally. Cane-sugar, according to Pavy, is partly inverted into grape-sugar and partly absorbed. All appear to be changed, when given

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in moderate quantities, into carbonic acid and water, even during slight fever.

In that form of constipation of small infants which depends on a relative absence of sugar and superabundance of casein in the breast-milk, the addition of sugar acts very favorably. A piece of loaf sugar (a teaspoonful or less) dissolved in tepid water (or oatmeal water) should be given before each nursing, and will often prove the only remedy required for the regulation of the bowels.

The physiological effect of *chloride of sodium* is very important, no matter whether it is directly introduced through the mother's milk, or added as a condiment to cow's milk, or to vegetable food. Both of the latter contain more potassium than sodium, and neither ought ever to be given, to the well or sick, without the addition of table salt. A portion of that which is introduced may be absorbed in solution; another part is, however, broken up into another sodium salt and hydrochloric acid. Thus it serves directly as an excitant to the secretion of the glands and facilitates digestion. Therefore during diseases in which the secretion of gastric juice is interfered with, or in the beginning of convalescence, when both the secreting faculties and the muscular power of the stomach are wanting, and the necessity of resorting to nitrogenous food is apparent, an ample supply of salt ought to be furnished. The excess of acid which may get into the intestinal canal unites with the sodium of the bile in the duodenum, and assists in producing a second combination of chloride of sodium, which again is dissolved in the intestines and absorbed. Its action in the circulation is well understood; it enhances the vital processes, mainly by accelerating tissue changes through the elimination of more urea and carbonic acid.

A very important fact is also this: that the addition of chloride of sodium prevents the too solid coagulation of milk by either rennet or gastric juice. Thus cow's milk ought never to be given without table salt, and the latter ought to be added to woman's milk when it behaves like cow's milk in regard to solid curdling and consequent indigestibility.

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Habitual constipation of children is also influenced beneficially, for two reasons: not only is the food made more digestible, but the secretions of the alimentary canal, both serous and glandular, are made more effective by the presence of sodium chloride.

A certain amount of *fat* is digested even in fevers of moderate severity, thus also in typhoid fever. But it is a good rule rather to reduce its quantity, because when infants were fed on cow's milk during capillary bronchitis, the fat in the *fæces* was known to amount to forty per cent. of the solid constituents. A few additional remarks will render the subject clearer, and show that it is very easy to give too much fat.

Infant *fæces* are comparatively copious, although the baby receives absolutely nothing but mother's milk. What has been called *detritus* in the *fæces* is not exclusively undigested casein, but principally fat and large masses of intestinal epithelium. This so-called *detritus* is not soluble in water, acids, or alkalies, but quite soluble in alcohol and ether. Casein is also present when it has been taken in too large quantity, or when there is too much free acid in the stomach. In those cases there are large quantities of it in the *fæces*.

An important practical application of this fact is the following: As it is true that fat is not completely absorbed, even under the most normal circumstances; as free fat acids are so easily formed and accumulated; as they are found in moderate quantities, even in healthy babies; as a surplus is very apt to derange digestion and assimilation, and to prevent the normal secretion of either of the digestive fluids; as there is a superabundance of fat in the normal food of the nursling, the conclusion is justified that we should be very careful in preparing foods for the healthy or sick. It is very easy to give too much fat. It is hardly probable that there is too little. The subject of "*fat diarrhœa*," which depends on the excess of fat in infant food, has been discussed on page 266. It is also well illustrated by the observations of V. and I. S. Adriance.⁹ They have succeeded in proving, by exact chemical and clinical researches, some facts which were known, but per-

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haps not sufficiently appreciated. Both excessive fats and proteids in the milk of the mother may cause gastrointestinal symptoms in the nursing infant; the former may be reduced by diminishing the nitrogenous elements in the mother's diet; the latter by the proper amount of exercise. Excessive proteids are especially apt to cause gastrointestinal symptoms during the colostrum period, and particularly during that of premature confinement, when their percentage is higher. Premature infants are, therefore, in particularly great danger, and their food ought to be greatly modified and watered.

In connection with this question I may also be permitted to allude to the indiscriminate administration of cream and the routine treatment with cod-liver oil in case of sickness; even normal digestion disposes only of a limited quantity of fat (cream, butter, cod-liver oil); twenty-five per cent. of it in the food, as lately recommended,¹⁰ is excessive. One of the preparatory stages of its assimilation is the formation of oleic acid; lipanin, which has been recommended in place of cod-liver oil, contains six per cent. of that acid, the physiological preparation of which the body is spared by its administration. There may be very few conditions in which the digestion is so slow as not to insure some of the required transformation, but in chronic dyspepsia of different sorts fat is badly digested and absorbed, and lipanin may take its place. A small amount of starch is digested at the very earliest age. But cereals containing a small percentage of it only are to be preferred. Barley and oatmeal have an almost equal chemical composition; but the latter has a greater tendency to loosen the bowels. Thus, where there is a tendency to diarrhœa, barley ought to be preferred; in cases of constipation, oatmeal. The whole barley corn, ground for the purpose, should be used for small children, not only the center (which is preferred because of its white color), because of the protein being mostly contained just inside and near the husk. The newborn ought to have its boiled milk (sugared and salted) mixed with four or five times its quantity of barley water, the baby of six months may take them in equal parts. Gum

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arabic and gelatin may also be utilized in a similar manner. They are not only diluents, but also, under the influence of hydrochloric acid, nutrients. Thus, in acute and debilitating diseases which furnish no or little hydrochloric acid in the gastric secretion, a small quantity of the latter, well diluted, should be provided for.

This, my method of infant feeding, which is suited for the stomachs and purses of the rich and poor alike, is, however, not the only one proposed and found satisfactory. No single method, indeed, is the only one, nor does it suit every case. It is only an occasional chemist who expects the organic stomach to behave like a chemical reagent; clinicians, however, admit exceptions to the working of their rules and regulations, though their conception were ever so correct and physiological. Still the endeavors to improve the diet of the young, and thereby to remove the dangers of intestinal disorders and the sources of excessive mortality and invalidism, are going on. Nothing has been more successful in that direction than the widespread practice of sterilization and pasteurization of cow's milk. Both are the logical development of the plan of treating milk by boiling which I have persistently advised these forty years at least, and detailed in my "Infant Diet"¹¹ in Gerhardt's "Handbuch,"¹² in Buck's "Hygiene,"¹³ in "Intestinal Diseases of Infancy and Childhood,"¹⁴ and in my clinical lectures delivered during more than one-third of a century. There can hardly be a doubt that if raw milk could always be had unadulterated, fresh, and untainted, and as often as it were wanted, it would require no boiling. It would even contraindicate it, for high temperatures destroy not only some of the dangerous bacteria, but also those whose action is desirable for normal digestion. Besides, there are those who strongly believe that boiling causes chemical changes. But such ideal milk cannot be had so long as cows are tuberculous, as scarlet fever and diphtheria are met with in the houses and about the clothing and on the hands of dairy men and women, and as typhoid stools are mixed with the water which is used for washing utensils.

Now, what is it that boiling can and will do? Besides

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expelling air, it destroys the germs of typhoid fever, Asiatic cholera, diphtheria, and tuberculosis, also the *oidium lactis*, which is the cause of the change of milk-sugar into lactic acid and of the rapid acidulation of milk with its bad effects on the secretion of the intestinal tract. Some varieties of *proteus* and most of *bacterium coli* are also rendered innocuous by boiling. Thus it prevents many cases of infant diarrhœa and vomiting, but not all of them, for the most dangerous bacteria are influenced neither by plain boiling nor by the common methods of sterilization. Boiling, or sterilization, is not, however, a safe protection under all circumstances. *Aërobic bacteria*, the so-called hay or potato bacilli, have very resistant spores, which develop in time. They are found in cow-dung and in the dust of stables, of the soil and streets, and of hay; they render the milk alkaline and bitter; they peptonize casein and liquefy it and make the milk still more bitter. They are very poisonous; their pure culture gives young dogs a fatal diarrhœa. It takes hours of sterilization to kill them; in some instances it required five or six hours. Even the *bacillus butyricus* takes an hour and a half. But such a protracted sterilization, besides being far from certain in its effect, is a clumsy procedure and one not calculated to benefit the milk. That is why hay-feeding is an absolute necessity, for the bacilli are destroyed by a six weeks' drying. Besides, it is important to keep the stables scrupulously clean, to avoid dirt and dust, to employ peat instead of straw for bedding, to wash the udder and tie the tails before milking, to throw away the first milk, and to remove foreign material from the milk by the centrifugal machine. But no absolute security can be guaranteed. Therefore Flügge adds to his expositions a warning against some wholesale manufacturers who, always anxious about somebody's—their own—welfare, were (are?) known to conceal the changed condition of the milk and the separation of butter particles by coloring the glass of their bottles.

Whatever I have here brought forward is certainly not to disparage the boiling of the milk; it is meant to prove the danger of relying on a single preventive when the

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causes of intestinal disorders are so many. It is true, however, that the large majority of the latter depend on causes which may be met by sterilization, but not by sterilization only; also by pasteurization,—that is, heating the milk to 70° C. (165° F.), and keeping it at that temperature for thirty minutes—a procedure which destroys the same germs that are killed by a more elevated temperature without much change in the flavor and taste of the milk. Pasteurization, however, is rejected by H. Koplik.

One of the questions connected with the employment of sterilized or pasteurized milk is whether the milk to be used for a child ought to be prepared at home, or whether the supply may be procured from an establishment where large quantities of milk believed to become immutable for an indefinite period by sterilization are kept for sale. In regard to this problem, Flügge plaintively expresses his regrets that “we have allowed ourselves to be guided by people who are neither hygienists nor physicians, but chemists, farmers, or apothecaries, and whose actions have been based on three false beliefs. Of these the first is that boiling for three-quarters of an hour destroys germs; the second, that whatever bacteria remain undestroyed are innocuous; and the third, that proliferating bacteria can always be recognized by symptoms of decomposition.” Nothing is more erroneous. Soxhlet himself, the German originator of sterilization, knew at an early period that the fermenting process is now and then but partially interrupted by boiling, that butyric acid may be found in place of lactic acid, that a strong evolution of gas may be caused after such boiling, and that such milk may give rise to flatulency. Indeed, milk which happens to contain the resistant spores of bacteria becomes a better breeding-ground for them by the very elimination of lactic acid, and the longer such sterilized milk is preserved and offered for sale the worse is its condition. It may be true that these conditions are not met with very frequently, but an occasional single death caused by poisonous milk will be more than enough. Therefore, the daily home sterilization is by far preferable to the risky purchase from wholesale manufacturers who cannot guarantee because in the

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nature of things they cannot know the condition of their wares.

Another alteration of a less dangerous character, but far from being desirable, is the spontaneous separation of cream from sterilized milk which is preserved for sale. Renk¹⁵ found that it took place to a slight extent during the first weeks, but later to such a degree that 43.5 per cent. of all the cream contained in the milk was eliminated.

Sterilization has been claimed to be no unmixed boon because of its changing the chemical constitution of milk. Still, opinions on that subject vary to a great extent, the occurrence of changes being both asserted and denied by apparently competent judges. But what I have said a hundred times is still true and borne out by facts—viz., that no matter how beneficial boiling, or sterilization, or pasteurization may be, it cannot transform cow's milk into woman's milk, and that it is a mistake to believe that the former, by mere sterilization, is a full substitute for the latter. It is true that when we cannot have woman's milk we cannot do without cow's milk. There is no alleged substitute that can be had with equal facility or in sufficient quantity. But, after all, it is not woman's milk. Babies may not succumb by using it, and may but seldom appear to suffer from it; indeed, they will mostly appear to thrive on it; but it is a makeshift after all and requires modifications. Hammarsten was the first to prove the chemical difference between the casein of cow's and woman's milk. Whatever was known on this subject at that time I collated in Gerhardt's "Handbuch."¹² The casein of woman's milk is not so easily thrown out by acids or salts as that of cow's milk, and is more readily dissolved in an excess of acid. But lately Wroblewski demonstrated the difference in solubility of the two milks. Woman's casein retains, during pepsin digestion, its nuclein (proteid rich in phosphorus) in solution, it is fully digested; in cow's casein the nuclein is not fully digested, a "para-nuclein" is deposited undissolved and undigested. Besides, woman's casein contains an additional albuminoid which is not identical with either the known casein or albumin (H. Hoplik¹⁶). Of the albuminoids in woman's

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milk sixty-three per cent. is casein, thirty-seven per cent. lacto-albumin (Schlossmann), which being directly absorbable constitutes an essential difference from cow's milk; all of the latter has to be transformed during the digestive process before it can be assimilated. Besides, there is (Wroblewski) in the human milk another proteid rich in sulphur, poor in hydrocarbon, and, according to several authors, in albumoses and peptones.

K. Wittmaack and M. Siegfried¹⁷ published lately their essays on nucleon (the phosphoric acid of muscle) in the milks of cow, woman, and goat, and on phosphorus in the milks of the cow and the woman. Their conclusions are accepted by E. Salkowski as correct, which, I should say, proves them to be so. Cow's milk contains 0.057, goat's milk 0.110 and woman's milk 0.124 per cent. nucleon. In cow's milk the phosphorus of the nucleon amounts to six per cent. of the total amount of phosphorus contained in the milk; in woman's milk 41.5 per cent. That means that in cow's milk not one-half of its phosphorus is in the organic combinations of casein and nucleon; in woman's milk almost all of it is. In cow's milk the phosphorus not utilized for organic combinations is contained in the inferior phosphates. E. Salkowski adds the following remarks: "These conditions are evidently of the greatest moment in the nutrition of the nursling. As the development of bones is more readily accomplished in nurslings fed on woman's milk than in those fed on cow's milk, the probable conclusion is that nucleon has an important part in the absorption and assimilation of phosphorus." The same should be said of calcium, which also combines with nucleon. Though woman's milk contains less calcium than cow's milk, more calcium is utilized out of the former, and the nucleon is evidently an important factor in its absorption also.

Ergo, cow's milk is not woman's milk. It is not identical with it. Sterilization does not change its character; it merely obviates such dangers as result from the presence of most pathogenic germs and from premature acidulation. The substitution of cow's milk or of sterilized cow's milk for woman's milk as the *exclusive infant food*

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is a mistake. Experience teaches that digestive disorders, such as constipation or diarrhoea, and constitutional derangements, such as rachitis, may be produced by its persistent use, and it appears to be more than an occasional (at least co-operative) cause of scurvy.

Since the advisability of finely dividing and suspending the casein of cow's milk and of adding to the nutritiousness of the latter caused me always to advise the admixture of cereals with it, even in the very first days of infancy, the subject of infant feeding has never been lost sight of by medical men, scientists, and tradesmen. No subject has been treated more extensively, more eagerly, sometimes even more spitefully, than that of infant feeding. The philosopher's stone has not been so anxiously sought for nor so often found as the correct infant food and the appropriate treatment of cow's milk in medical journals, books, and societies.

The debilitating influence of persistent summer heat may be counterbalanced by improving the vitality and resisting power of the young. It is true no newborn baby should be bathed in cold water, but the gradual diminution of the temperature of the water used for ablutions may go on until after a few weeks or months the healthy infant bears washing and friction with cold water perfectly well. In the heat of summer it should be so treated several times a day. The clothing should be quite thin; those who perspire freely should have no linen next to their bodies; altogether, cotton or thin flannel, both of which gradually absorb and give off perspiration, are preferable. In very warm weather a single loose gown should be sufficient. No feather beds or pillows should be permitted. Surely the baby would be better off in a hammock, the head being supported by a hair or air pillow. Babies in bed should have their positions changed from time to time.

The mouth of the newborn infant requires the utmost care. It is a frequent inlet of microbes and toxins, and when its mucous membrane is injured, it adds a new element of danger to the different forms of intestinal and septic disturbances which are not at all uncommon at the

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earliest age. The attempts at cleansing the mouth may prove dangerous. All the integuments of the newly-born are in a condition of desquamation. Clumsy rubbing with coarse or stained cloths by the fingers of a nurse or doctor that are not absolutely aseptic, is a direct cause of infection. Even the water in which the baby is bathed may add to that danger. What is called Bednar's aphthæ is nothing but the ulcerations of the very thin mucous membranes mainly on and near the alveolar processes; these heal but slowly and complicate every disorder of an infectious nature. If such a mouth is filled with sugar, teas, or syrups of questionable composition, the consequences are often bad.

Cow's milk will always be one of the foods administered at any age. In the country, when the cattle are not tuberculous, and when no diphtheria, scarlatina, and typhoid fever can vitiate the milk, it should be given fresh, modified by the addition of barley or oatmeal water. City milk is no longer fresh. In many medium-sized European cities milk is delivered within four hours after milking (in Frankfort, for instance, since 1877); in New York it takes from ten to sixteen hours or more. No such milk, unchanged, is fit for the use of young infants. Boiling, sterilization, or pasteurization is therefore indispensable, partly to destroy the bacterium *aërogenes*, partly to render innocuous such pathogenous germs as may have been admitted during the long time which elapsed between milking and consuming.

Even if it were possible to compound an accurate substitute for breast milk, this has the advantage of its freedom from pathogenous germs, and of its changeability under divers circumstances. Alterations of breast milk depending upon moderate changes of food taken by the mother or wet-nurse are as a rule not hurtful; its dilution by the ample quantities of water taken by them in hot weather is a direct advantage to the nursing. The same quantity and quality of food is not equally digestible in summer and in winter; what is well borne and demanded in the winter, by the adult or by the young, proves an excess in summer. "Modified milk," "Gaertner's milk,"

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and their like are always the same, day in and day out; breast milk, however, may change. The main danger attending the uniformity of food is, in hot weather, the insufficient amount of water, of which our babies do not receive enough. Casein, sugar, fat, and salts should not only have their due average admixture of water, but the latter should be given in extra doses during hot weather. Perspiration thickens the blood, hinders the circulation, and may even lead to thromboses; it is good practice, therefore, to give breast-fed children a drink of water—which should be boiled and thereby sterilized—before each nursing; and to dilute the artificial food given to those who are brought up on the bottle, and to let them all have water between meals to their heart's content.

TREATMENT

The most perceptible symptoms of cholera infantum are vomiting and diarrhœa, both of which are in the large majority of cases—to say the least—the effects of irritation or paralysis caused by bacteria and toxalbumins. Whatever is still within reach and active, should be removed by irrigation. If there is reason to suppose that the stomach still contains foreign materials, it should be washed out, no matter whether the attack is attended with fever or not. Both bacteria and toxalbumins may prove fatal without much increase of temperature; indeed, many attacks of cholera infantum behave in this respect like diphtheria, puerperal fever, or other septic processes, the worst forms of which are often accompanied with low temperatures. A mouth gag is not always required for the purpose of irrigating the stomach, but in most cases it facilitates the procedure; a cork firmly planted between the alveolar processes will generally suffice to enable the fingers to perform their work. No solid stomach tubes should be employed. Soft elastic catheters, Nos. 16 to 30 French, according to age, will suffice. The baby, wrapped up in a blanket and sitting on the lap and between the arms of an attendant, is satisfactorily immobilized, and its head is sufficiently fixed and bent forwards

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so as not to narrow the space between trachea and vertebral column. There are but few cases in which the œsophagus is missed at the first attempt; when the tube has once entered, the slight contraction behind the larynx is easily overcome, and the catheter slides down. By means of a glass tube and an india-rubber tube attached to it, the connection with a funnel, through which tepid water is slowly poured in, is easily established. The flow is graduated by the elevation of the funnel. When a few ounces have been allowed to fill the stomach, the funnel is lowered and the liquid runs out. The same procedure is repeated, while the amount of liquid is increased, until the water returns clear. Vomiting alongside the tube is not harmful. The "fountain syringe" in common use among us will answer every purpose. In individual cases, when the indication of direct disinfection appears urgent, the tepid water (or 0.6 per cent. salt solution) may contain resorcin (one per cent.) or thymol (.02 per cent.) or permanganate of potassium (.02 per cent.). As a rule these additions will not be required; nor is the irrigation of the stomach indispensable when the patient is seen some time after the vomiting has ceased. In bad cases, however, any doubt in that respect should be dismissed in favor of irrigation. It will not often be required a second time.

The next step in the treatment of cholera infantum is the washing out of the intestinal tract as far as it is accessible. The fluid to be introduced is the same as above. In a number of instances when there seemed to be intense pain or tenesmus, I have mixed subcarbonate or subgallate of bismuth with the water. The baby should be placed on one side, the nozzle of the fountain syringe introduced a few inches, and the instrument suspended a foot or two over the anus. To facilitate the flow, the hips should be somewhat raised; in some instances the gentle manipulation of the abdomen answers the same purpose. To introduce a long tube in order to reach the colon is either unnecessary or contraindicated. For in the infant the sigmoid flexure is so long that no tube passes the convolutions which are apt to cover one another, and sometimes reach to the opposite side of the upper pelvis. When the tem-

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perature of the body is high, the injection should be cool; when there is collapse, it should be hot. In the latter case, a small amount of alcohol (one per cent.) or good brandy or whiskey (two or three per cent.), or coffee should be added to the injection. These irrigations should be continued until the fluid returns clear; they should be repeated when the diarrhœa returns, and particularly when the stools are offensive. That all the injected fluid should be expelled is not necessary; on the contrary, as the loss of organic water has been great, and some of the dangers of cholera infantum depend on that very loss, it is desirable that the intestine should retain and absorb some fluid. That loss is so serious indeed that the introduction of water becomes an urgent necessity. To fulfil this indication in emergency cases, subcutaneous infusions of salt water (6:1000), with or without the addition of sodium carbonate (10:1000) are required. The water, however, should be sterilized, and the whole procedure must be aseptic. It is true that many of the cases which indicate it will die; but it is not the infusion, but the disease that kills. I feel certain that a few of the patients I have seen the last half-dozen years were thus saved.

In connection with the question to what extent disinfectants added to the irrigations destroy bacteria or other toxins, I should state here that this effect need not be accomplished and still salutary action may be obtained. Many years ago Prudden proved that a one-twentieth of one per cent. solution of carbolic acid annihilates the action of bacteria, not indeed by killing but by paralyzing them. To prevent them from evolving toxins is as beneficial as to destroy them.

The same remark should be made in regard to those internal remedies which appear to be indicated, mainly in those cases which owe their origin to, or are evolved out of any of the forms of prodromal enteritis or enterocolitis, for the purposes of disinfection. Vaughan believes that much harm and no good can be obtained from them, but every clinician knows that the eminent bacteriologist is mistaken. It is true that calomel, naphthol, naphthalin, salol, and camphor in medicinal doses do not diminish the

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number of bacteria nor even of saprophytes, but the effect of the microbes becomes less virulent.

Constant vomiting forbids the introduction of food or drink. Whether there be thirst or not, the patient must be starved. While he is so deprived his thirst will decrease rather than increase. This period of total abstinence may last from four to twelve hours. After this some bear small pieces of ice quite well; but to begin with it too early excites vomiting and peristalsis. A teaspoonful of boiled water, cooled, may be given every five or ten minutes. That may be alternated with, or replaced by thin and thoroughly cooked and strained barley water. It is un-irritating and well borne. What a critic¹⁸ of Pepper's text-book says, viz., that "thousands of children are killed by the injudicious" (?) "use of barley water"—that this is "a popular fallacy" and "merits oblivion," is a mistake and reads like a huge joke. Later on egg water may be given, that is the white of a fresh egg beaten up, and finally shaken in a bottle containing 150 or 200 c.c. of barley or rice water, in small amounts.

No milk must be given at this stage; no sterilized or pasteurized milk, no breast milk. It is true that under ordinary circumstances milk feeds babies, but in these extraordinary circumstances it feeds bacteria. No milk must be given, if it take a week or more, until the alvine discharges begin to change, and are no longer malodorous. Now and then a teaspoonful of a mild tea, or a few drops of a good whiskey in barley water may be given once every five or ten minutes, or at longer intervals. A mixture which has served me well in many cases, after the starvation period had passed and the stomach began to exhibit some little tolerance, is the following: One hundred and fifty cubic centimetres of barley water, the white of one egg, one or two teaspoonfuls of whiskey, some salt and cane sugar to improve the taste. Of this a teaspoonful is administered every five or ten minutes.

When milk is to be fed again it should not exceed ten per cent. of the barley water with which it is to be mixed. To prepare it with hydrochloric acid, according to the prescription of Dr. Rudisch which I have frequently used

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these more than twenty-five years, will often be found profitable. The method is to mix 2 c.c. of *dilute* hydrochloric acid with a pint of water and to add thereto a quart of milk. This is to be boiled. If ever there be coagulation, it merely proves that the acid was mistakenly used in excess.

Internal medicinal treatment is mainly indicated in those cases which developed on the basis of a dyspeptic, catarrhal, or follicular enteritis. As irrigations of the rectum act on the lower part of the bowels only, the small intestines may be cleared by a purgative. If castor oil be retained, it will have a good effect. To mix it with tincture of opium is unwise at that stage in which the emptying of the tract of injurious masses is the main indication. Calomel may take its place, and will be well tolerated in frequent (hourly) doses of 4 to 5 mgm. (gr. $\frac{1}{15}$ to $\frac{1}{12}$). It should be continued until the stools show its effect, which they will do though the remedy remain in the mouth and be there absorbed after having been transformed into a mercurial albuminate. If there be an excess of acid (lactic, acetic, or butyric) in the stomach, calomel should be combined with an alkali, mainly chalk, the carbonate and phosphate of which have the additional advantage of forming with the fat an insoluble combination which acts as a protective cover to the sore mucous membrane. Doses of from 5 to 10 cgm. (gr. i.-iss.) may be given every two hours. The subnitrate, the subcarbonate, or the subgallate of bismuth in doses every two hours of from 15 to 100 mgm. (gr. $\frac{1}{4}$ -iss.) acts as a disinfectant, partly by binding sulphide of hydrogen, and protects the sore surfaces. Salol should not be given in larger doses than from 3 to 15 cgm. (gr. ss.-iiss.), resorcin from 15 to 30 mgm. (gr. $\frac{1}{4}$ - $\frac{1}{2}$). These are preferable to many others because of their indifferent taste. When the time has arrived for astringents, nitrate of silver in solution, 2 to 4 mgm. (gr. $\frac{1}{30}$ - $\frac{1}{15}$) in a teaspoonful of water, or gallic acid in doses of from 5 to 15 cgm. (gr. i.-iiss.), or tannalbin or tannigen, in doses of from 3 to 12 cgm. (gr. ss.-ii.)—all of them in intervals of two hours—may be administered.

CHOLERA INFANTUM

Are there any indications for opium, or is it totally contraindicated? It certainly limits secretion and hyperacidity better than morphine. Its effect is slower than the latter, and therefore safer and local. It also diminishes hyperperistalsis; it is, through its effect on the sensitive nerves or on the ganglia, a sedative, and an inhibitory agent through strengthening the splanchnic. Finally it relieves pain. Thus it is readily seen that in the incipient stages of dyspeptic and stercoraceous diarrhœas it finds no place, but when the bowels are emptied, it fulfils its indication of relieving pain and hypersecretion and of stimulating—in small doses—the heart. Under these conditions a baby of six months may take from four to ten drops of the camphorated tincture of opium, or an equivalent, every two, three, or four hours.

Great sensitiveness of the abdomen may also be relieved by warm fomentations, with water, or with poultices. They should be covered with oiled silk, or an india-rubber cloth and flannel. Care should be taken lest the clothing and bedding get moist. Warm bathing may occasionally take their place. In cases of collapse the temperature of fomentations or baths may be raised a little beyond the normal temperature of the blood. When there is great pain combined with high temperature of the body, cool applications to the abdomen are indicated. The cloth wrung out of cool water, secured and protected as above, should be changed when it becomes hot.

Great care should be given to the relief of the exhausted and paralytic condition of the patient. There are those cases which require stimulation at once. It is indicated when the fontanelle is depressed at an early time, the pulse very small and frequent (150-220) and hardly perceptible at the wrist, and the complexion ashy. To rely on internal stimulants is out of the question; there are, however, many opportunities for subcutaneous applications of the salicylate (or benzoate) of sodiocaïne, of the sulphate of strychnine, of camphor, or of whiskey. The first may be employed in doses of from three to eight drops of the saturated solution (1:2), the second in doses of from 0.5 to 1 mgm. (gr. $\frac{1}{120}$ - $\frac{1}{60}$), the third in

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doses of from four to ten drops of a solution of four times its weight of sweet almond oil; of the last from fifteen to twenty-five drops may be injected. All of these administrations may be repeated according to indications. The same remedies may be used internally if the condition of the stomach permit. The very best stimulant is Siberian musk, of which from 3 to 10 cgm. (gr. ss.-iss.) may be given every half-hour, until from three to six doses will have been taken.

BIBLIOGRAPHICAL REFERENCES

1. Biedl und Kraus: *Zeitschrift für Hygiene und Infektionskrankheiten*, xxvi., p. 376, 1897.
2. Fischl und Heubner: *Zeitschrift für klinische Medizin*, xxix., 1896.
3. Uhlenhuth: *Zeitschrift für Hygiene und Infektionskrankheiten*, xxv., p. 476, 1897.
4. Booker: *Johns Hopkins Hospital Reports*, vi., 1896.
5. Meinert: *Medical Annual*, 1893.
6. Jacobi: *Medical Record*, December 18, 1868.
7. Clarke Miller: *American Journal of Obstetrics*, 1879.
8. Jacobi: *Therapeutics of Infancy and Childhood*, 2d ed., Philadelphia, 1898.
9. V. and I. S. Adriañce: *Archives of Pediatrics*, 1897.
10. Berliner klinische Wochenschrift, June 14, 1897.
11. Jacobi: *Infant Diet*, New York, 1874.
12. Jacobi: *Die Pflege und Ernährung des Kindes in Gerhard's Handbuch der Kinderheilkunde*, vol. i., 1877 (2d ed., 1882).
13. Jacobi: *Infant Hygiene in Buck's Hygiene*, New York, 1883.
14. Jacobi: *Intestinal Diseases of Infancy and Childhood*, Detroit, 1887.
15. Renk: *Archiv für Hygiene*, xvii., 1893.
16. H. Hoplik: *New York Medical Journal*, April 13, 1895.
17. Wittmaack und Siegfried: *Zeitschrift für physiologische Chemie*, xxii., 1896-97.
18. Book Review in *The American Therapist*, June, 1894.

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THE literature of the typhoid fever in infancy and childhood is very copious; that of the last twenty years is not exactly worthless; indeed, a number of magazine articles are quite valuable. But they do not compare with the very first publications on the subject which appeared at a time when typhoid fever had not long been recognized as an independent morbid entity. Amongst those which should be read to-day, in order to gather almost everything connected with the subject, with the exception of the Diazo and Widal tests, are Tapin, in the *Jour. des Conn. med. et Chirurg.* of 1839, who explains the apparent infrequency of typhoid fever in the young by the mildness of most cases; F. Rilliet, *De la fièvre typhoïde chez les enfants*, Paris, 1840; the article on the subject in Rilliet and Barthez's great Handbook in 1853; Louis and Andral in 1841; a paper of A. Baginsky in Virchow's *Arch.* Vol. 49; of Henoch in the *Charité Ann.* Vol. II, 1877; the thesis of Georges Montmoullin, 1885 (*Observations sur la fièvre typhoïde de l'enfance*), and the article of C. Gerhardt in the second volume of his great "Handbuch," in 1877. The most meritorious of all the contributions to the knowledge of our subject, however, is the little book of Edmund Friedrich, *Der Abdominal Typhus der Kinder*, Dresden, 1856. My advice to all modern and future writers on any topic connected with the question of typhoid in children is to first consult the 102 pages of that monograph, which is apt to teach the often forgotten lesson that medicine is not of to-day nor of yesterday; that there have been great and good men worth knowing, before we were born, and that the history of our science and art is sadly neglected amongst us.

Infection and Contagion.—The opportunities for infection or for contagion are the same for the young and for the old. The bacillus has been found active though it had

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been dry for months; in the soil and in clothing after one or two months. Into water and into the soil it is introduced with typhoid discharges which carry contagion though they have been in contact with putrid material. This experience explains isolated cases and those attributable to the influence of sewers and privies, and the transmission through the atmosphere. Flies have been charged with carrying the poison. Infected water that is used for drinking or for washing the bottles and cases in which milk is kept, is responsible for hundreds of epidemics. Contagion from patient to patient in a hospital or in a tenement, by bedding, by the hands of the attendant, by the use of the same unwashed thermometer for the typhoid and non-typhoid are surely either possibilities or facts. The fetus and newly born may obtain their typhoids through the blood of the mothers; contagion through the milk of the mother is not improbable, though in most of such instances the suspicion may be directed to other sources of the malady. Small infants have a great advantage in this that their typhoids are not frequently attended with characteristic stools, and that for this reason a hospital case is not so dangerous to its neighbors; that they are not roaming about the floors where older children pick up infection, and that the water they drink or eat is almost always boiled. The latter fact alone explains the relative absence of typhoid fever from the first year of life.

SYMPTOMATOLOGY.

Temperature.—The severity of the illness need not correspond with the body temperature. A girl of 9 years, whose case is reported by Gerloczy, in *D. Med. Woch.*, No. 15, 1892, had unconsciousness, diarrhea, very frequent pulse, universal hyperesthesia, roseola, abscesses, and bronchial catarrh, and got well after thirty-nine days. During all this time there was no increase of her body temperature. It appears that very severe cases of typhoid fever when exhibiting bad cerebral symptoms are liable to have low temperatures on account of the thorough sepsis prevailing. If so, the prognosis is very bad.

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Belei Medvei (Intern. Klin. Rundschau, 1891, No. 35 and 36) observed a girl of 12 years that was taken sick with severe headache, restlessness, chill, pain in neck, unconsciousness, miosis, unequal pupils, rapid respiration, and a temperature for four days from 36.8° to 37.5° C. Then the temperature rose and the typhoid symptoms of spleen and cecum, and diarrhea made their appearance.

This absence of high temperature does not astonish those who see a good deal of sepsis and of sickness complicated with weak heart. Temperature and danger need not correspond. The very feeble are not as a rule subject to high temperatures any more than the very old; and quite often the worst cases of sepsis are those which exhibit low temperatures. That is a fact best known to those who see much diphtheria or much puerperal fever.

Observations of high temperatures previous to the appearance and recognition of the symptoms are not frequent. While an adult would be about his work, the infant or child is seldom considered sick enough to claim attention and attendance. That is why chilliness and chills are readily overlooked; indeed, the latter are not marked as a rule in any illness of the young. The rise of the temperature in the typhoid of the young is mostly gradual; it is high in the second stage with slight remissions and gradually falls toward the end of the disease. This rule, if it can be called so, is, however, subject to many exceptions. The temperature of small infants may be very irregular, is in many cases rather low and uniform, in others high with few and short remissions. Irregularities, moreover, often depend on complications. After all, neither those are always right who consider the typhoid of the nursing and infant as a uniform severe disease, like Baginsky and Roemheld, nor those who make light of it. The degree of individual infection, and the nature of the epidemic are factors that have to be considered.

Complications which disturb the regularity of the temperature curves are, for instance, otitis, which is quite frequent. In connection with it we should not forget that the otitis media of the infant need not terminate in perforation of the drum membrane; for the pharyngeal end

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of the Eustachian tube is so large a funnel at that early age as to permit the discharge of pus from the middle ear. An occasional complication is scarlatina; in the last two years malaria was a more frequent complication of typhoid than I have ever known it to be. Suppurating arthritis, diphtheria of the throat or of the vulva, both bacillary and streptococcic, are detrimental in the same way. Constipation is also an occasional cause of the rise of temperature; the regular visiting hours of hospitals, even without clandestine feeding, are apt to increase temperatures. Now and then there are two regular daily curves. That is another reason why the rectal temperature should be taken at least four times in twenty-four hours.

Digestive Organs.—The condition of the lips, the tongue and the mouth may depend on previous catarrh, angina, or the presence of adenoids; otherwise on the severity of the typhoid, and exhibits the same surface changes of the epithelium and mucous membranes that are observed in the adult. The lips are frequently dry, the tongue mostly moist, its epithelium accumulated in the centre, the edges red, or the whole tongue red and dry, covered with dry epithelial scabs, torn or ulcerated. Large ulcerations are mainly noticed during unconsciousness, smaller ones may be quite numerous on the hard and soft palate in every severe case. There is no herpes. The throat shows angina, the tonsils are swollen, in exceptional cases covered with a pseudomembrane which once, in a boy of 9 years, continued through the whole length of the esophagus to below the cardia. In bad cases of older children, or in the few that occur in the nursling when the mouth is kept open because of the narrowness in the naso-pharynx, of indolence or unconsciousness, thrush is met with as it is in the worst cases of adult typhoid, or in moribund phthisis. Stomacace is less frequent, noma still less so; the latter is observed only toward the end of the illness, or during apparent convalescence. Fortunately, during nearly fifty years I met with half a dozen cases only, one in a baby of 8 months, one in a girl of 11 years, all fatal. Baginsky, however, reports a case of noma that recovered. It may be added that noma is not quite so frequent after typhoid

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fever as after some other infectious diseases, prominent amongst which is measles, where I have seen at least a dozen instances. Parotitis may terminate in perforation, either outward or through the external ear. An abscess of the submaxillary gland I have seen in few cases only. Otitis media is an occasional complication originating in pharyngeal changes. The appetite is proportionate to the fever, the dry mouth and the degree of unconsciousness; during convalescence the hunger is great and conducive to dangerous mistakes in diet. Vomiting is noticed in bad cases, and is caused by the condition of the digestive mucous membrane, occasionally by meningitis, and sometimes by accompanying or consecutive nephritis.

Diarrhea is a frequent symptom in typhoid fever, either before its apparent outbreak, or in the first week, or at a later period. It appears to be of a catarrhal nature, induced probably by the presence of bacilli and their toxins. In the later periods of the disease it certainly depends on the presence of ulcerations. But to expect diarrhea as a common symptom is a mistake occasioned by the statements of many European books. In the other hemisphere diarrhea appears to be more general than with us. I think we miss it in one-half of our cases.

Even the assumption that where there are ulcerations there must be diarrhea is not founded on uniform facts. In ward 28 of Bellevue, in 1877, I had a girl of 11 years that was under close observation during her typhoid fever for several weeks. The case was one of unusual severity—spleen, lungs, skin and nervous system yielding the usual symptoms; there was no diarrhea at any time. She died with the symptoms of perforation. Perforation caused by one of the typhoid ulcerations was found at the autopsy. Nor is this the only case of the same description in my experience. In the Proceedings of the Pathological Society, twenty-five years ago, there is mentioned the case of a man who died in my service in Mount Sinai, also with perforation of an ulcerating intestine, with no previous looseness of the bowels.

Constipation is not an uncommon symptom in the beginning of typhoid fever of the young, though diarrhea may

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develop toward the end of the first or during the second week, while, on the other hand, diarrhea may be observed among the prodromi or in the first week, and be replaced by constipation.

Almost in all cases of typhoid, in the young and in the old, intestinal ulcerations are common. But exceptions to this rule are met with.

S. Flexner and N. M. Harris (Bull. Johns Hopkins Hospital, December, 1897) detail the case of a man of 68 years who had typhoid fever with bacilli in many organs, but no intestinal lesions; A. G. Nichols and C. B. Keenan (*Montreal M. Jour.*, January, 1898) one with positive Widal test, and tumefied spleen and mesenteric lymph nodes, and no intestinal lesions; E. Hodenpyl, one that died on the seventeenth day of illness with ulcerations in the large intestine, but none in the small. This absence of intestinal lesions is rare indeed in the adult; in the young, mainly in the very young, it seems to be less rare. As a rule, it may be stated that the intestinal tract suffers more in advanced age, the blood more in the early.

According to Bryant (*Brit. Med Journal*, 1899, I., p. 766) fifteen cases of typhoid fever are known to have exhibited no intestinal lesions. His case was that of a boy of 1 year and 9 months; it occurred in a family in which there were other cases of typhoid fever. There was a characteristic fever curve, diarrhea, tympanites, tumefaction of the spleen, and a positive Widal reaction. At the autopsy there were pure cultures of bacilli in the enlarged mesenteric glands, but no intestinal ulceration.

In one of his autopsies Henoch found but one Peyer's plaque that was slightly swelled.

In *N. Y. Med. Journal* of July 29th, A. J. Hartigan, assistant in the Bender Laboratory of Albany, N. Y., reports two cases of typhoid infection without any intestinal lesions. Of the older literature of such instances he quotes Louis, more than half a century ago, and Litten, Moore, and Church between 1880 and 1882. He then continues: "The bacteriological era in the investigation of these forms begins with Banti, in 1887. In his case death took place on the twenty-eighth day of the disease. No intestinal

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lesions were found, but the spleen and mesenteric glands were swollen; in them bacilli morphologically similar to the bacillus typhosus were found." He quotes seventeen authors, and adds his own cases, without, however, mentioning Hodenpyl.

It should, however, be stated that the statistics of intestinal ulcerations with perforation are not conclusive; many are observed in private practice, not counted, not reported, and forgotten. Now and then, again, a case is reported as a curiosity without reference to the number of cases observed and other important points. Barrier met with two perforations in 24 cases, a very unusual proportion.

Montmoullin reports seven cases in which perforation was diagnosed, three of which recovered—a proportion of spontaneous recoveries able to arouse the jealousy of any operator.

Barrier and Bouchut made long ago similar observations on the adult, so that they concluded that the anatomical alterations of the intestine may be absent. Chiari (*Z. f. Heilk.*, 1897) while finding lesions in the stomach, and bacilli in different organs, and septic symptoms, found no intestinal lesions. In nineteen collected cases, while the Widal test was positive, the same absence of intestinal lesions was marked. So the latter is not conclusive. The last case of the same nature was published by A. Mc. Phedran in the October issue of the *Phil. Monthly Med. Journal* (1899).

Gurgling in the ileo-cecal region, both with and without pressure, is common in intestinal catarrh, both infectious and non-infectious; that is why, under ordinary circumstances, it should not be held to be characteristic of typhoid fever. It would be more so, if complicated with constipation, and with some of the more frequent symptoms of typhoid fever.

Incontinence of the sphincter ani when met with is not so much the local result of the infection as of unconsciousness; when it occurs during convalescence, it depends on hyperperistalsis, mostly combined with colic.

Tympanites is usually very moderate, for extensive peritonitis is very uncommon, except with perforation. Sensi-

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tiveness of the abdomen is frequent, without the diagnosis of local peritonitis being always within easy reach. This latter form is, however, quite frequent, for in the autopsies of children, or of adults who died of other diseases, local discolorations and thickenings, of a grayish white, or yellow color, are often found on the peritoneal layer of the intestine, above, near or below the cecum. They are the results of previous local peritonitis corresponding with the locality of ulcerations during typhoid fever, or any of the forms of enteritis in former years. Unexpected perforations of the intestine, occurring in advanced years, during apparently perfect health, are the final results of such local peritonitis.

Hemorrhages in the very young are exceptional, and mostly mild in children of more than four years. I have seen it more than a dozen times. In a girl of 10 years, the loss of blood was such, there being several hemorrhages in the course of the third week, that I attributed the supervening heart failure to exhaustion only. Both the number and severity of the hemorrhages appear to depend on the character of the epidemic or on the season. In the very young, I sometimes saw no tinge of blood in five years, and in a single season eight years ago I met with two, not fatal, cases of hemorrhage, in girls of 5 and 7 years. This very autumn I have seen four cases of typhoid fever in children of from 5 to 9 years, in which mild hemorrhages occurred. Of Henoch's nine intestinal hemorrhages, five were quite mild.

Circulatory Organs.—The organs of circulation are not affected to the same extent as in adults. The average heart of the young is stronger, and less diseased. Endo- and pericarditis, embolisms and thromboses are rarer than in advanced age, except in very bad and protracted cases, in which the myocardium was deteriorated by the bacillary toxin. For the same reason complete adynamia is not so frequent at least in the first week or weeks. During increasing inanition, however, the circulation is impaired, as best shown by the coldness of the feet. The gums bleed but rarely, the nose not so often in infants, and the very young, as in older children. The pulse, mainly during the

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first two weeks, except in the small infant, where it is liable to be feeble and frequent, is either in correspondence with respiration and temperature, or frequently slower and quite strong. When it becomes feeble and frequent, with or without intermissions, it impairs the prognosis, and demands persistent stimulation. It is rarely dicrotic.

When it is in this weak condition, the heart sounds are no longer distinct; they are muffled, one or the other splits in two, and an apex murmur becomes audible. This should not be taken as merely functional; the myocardial weakness which occasions it is toxic and organic, and may remain a permanent lesion.

Spleen.—The irregular respiration of nervous, or frightened infants and children, their tympanitic colon, and high diaphragm, possible exudation in left pleura or lung, and the struggle against examination, whether painful or not, render the diagnosis of the condition of the spleen difficult. In perhaps one-half of the cases it is, however, successful. Percussion succeeds less than palpation, which may reveal the lower edge of the spleen. It is rarely felt before the end of the first week, about the time when roseola appears; earlier, however, when the fever is unusually high. When it diminishes rapidly in the middle of the third week, the prognosis is good; if not, there will be a relapse. When a relapse takes place, the spleen, which was greatly reduced in size, is liable to swell very rapidly. Permanence of this swelling of the spleen, however, is much rarer after typhoid than after severe malarial fevers, and abscesses are quite exceptional.

The Respiratory Organs.—The nasal mucous membrane is dry, covered with thin crusts, and irritated like the lips, which are in a similar condition. Epistaxis is not infrequent in older children. Together with pharyngitis there may be a catarrhal laryngitis. This, and the dryness of the mucous membrane cause hoarseness and cough. Edema of the glottis, which is fortunately rare, causes dyspnea and strangulation. Superficial and deep ulceration of the trachea or larynx, and perichondritis are exceptional, but I have met the necessity of performing tracheotomy in such cases twice. One was the case of a girl of seven, in

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which scarification of the interior of the larynx was unsuccessful—the child was saved by the operation. The other tracheotomy was made during convalescence on a boy of ten years, because of an abscess developing over and behind the manubrium sterni. He died after many weeks of pyemia, the main source of which was found about the lowest rings of the trachea, and the mediastinal lymph-nodes. Bronchial catarrh is frequent, without much cough, as long as the respiration is shallow; with cough on deep respiration; catarrhal pneumonia is not rare, and mostly bilateral; croupous pneumonia is also apt to be bilateral. The more frequent form of pneumonia, however, in the protracted cases of feeble patients, is hypostatic, with a tendency to become bilateral at once, and to extend. Pulmonary gangrene is exceptional, but should be feared in every case of infectious broncho-pneumonia, complicated with a weak heart.

Pleuritis is comparatively rare, purulent in exceptional cases only, sometimes sanguinolent, though there be no complication with tuberculosis.

Complications with diphtheria of the bacillary variety (nasal, pharyngeal, or laryngeal), are not common. When they occur during the prevalence of a diphtheria epidemic, they are grave accidents.

Urinary Organs.—The urine is mostly of a high color, contains in the beginning much urea and uric acid, less chlorides than normal, indican sometimes, albumin frequently at an early period and more so during the height of the disease, renal epithelia, blood, thin granular casts, and occasional bacilli. The renal irritation exhibited by the microscopic appearance is that which is usual in most infectious diseases, and is due to the effect of the toxin while being eliminated through the kidneys. Symptoms connected with this elimination need not be very marked and need not lead to nephritis. Still, the latter may follow. Even pyuria has been found, for instance, by G. Blumer, in children, one of 13 and one of 10 years (Johns Hopkins Rep., Vol. V).

Retention of urine is rare in children, but occurs when there is coma or much peritonitis. In that case, and when-

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ever it is important to secure urine for examination, catheterizations should be resorted to. It is more easily performed in the young than in the adult and more readily in boys than in girls. Under ordinary circumstances, when the catheter is not employed for some reason or other a big ball of absorbent cotton will collect urine enough for the usual examination of the urine. Polyuria is seen during convalescence when much water is drunk. In that period dropsical effusions may be observed with or without albumin; it should also not be forgotten that salicylic acid or antipyrin when employed may cause edema; and, further, that there may be nephritis without albuminuria. The Diazo test is mostly positive towards the end of the first week, and remains so until the middle of the third, sometimes very much longer. At all events, however, its absence is no proof against the presence of typhoid fever. Roemheld missed it altogether in many cases.

The observations made by Lafleur and others, that the urine voided after cold bathing exhibits a high degree of toxicity, would rather speak in favor of that treatment; for the more toxic the urine and dangerous to the laboratory animal, the less toxin there is left in the patient. Elimination, as speedily as possible, is what should be aimed at. And whatever diuretic effect there is in cold bathing, as in other remedies, is welcome as long as the condition of the patient permits it. How rarely that is so, will be seen in the remarks I have to make on therapeutics.

Skin.—The tendency of the skin is to be dry; that is why chronic eruptions are liable to disappear during the illness and to return when recovery is complete. This dryness is also the cause of the transverse fissures under the knee which Koebner explains by the co-operation of the lifeless epidermis, the vigorous growth of the extremities and the flexed posture of the knee; it also causes the extensive desquamation before and during convalescence.

The characteristic roseola exhibits the same peculiarities that are noticed in the adult; it is absent in perhaps 20 per cent. Morse collected 671 cases, in 406 of which it was present; Henoch found it 362 times in 381 cases. It is not uncommon in the very young. I found a few spots on the

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epigastrium of a newly born that died on the sixteenth day of its life; Gerhardt (Handb. Vol. II, p. 373) met with roseola (and a tumefied spleen) in a baby of three weeks. It may appear as late as the eleventh, even the fifteenth, or seventeenth day, is mostly not so copious as it is in the adult, and occurs preferably on the chest and abdomen, but also on the back and on the extremities. When the temperature is high at an early date, roseola may appear early, on the third or on the fourth day, and new crops may occur afterwards. In relapses it is more frequently missed than in the primary attack, but a new crop in the fourth week means a relapse. Petechiæ are not frequent, but do occur in children of more than seven or eight years, also in the very young; when complicated with extensive purpuric extravasation they are ominous.

Miliaria is sometimes observed when there is exceptional perspiration; and erythema during the height of the disease when there is much intestinal disorder and coma as the result of direct toxic, or of auto-infection. Eczema is the result of uncleanness only; gangrene, abscesses, furuncles, and pustules are frequent occurrences, but in the later periods of the disease only.

In bad cases, and mainly when the hygiene of the skin was neglected, abscesses will appear in it and in the subcutaneous tissue, preferably on the head, face and chest. Slight irritations are sufficient to act as proximate causes. A child of two years developed the first abscess on the epigastrium in consequence of a subcutaneous injection of quinin. More followed, mainly on the hands, fingers, and feet, more than sixty were incised in the course of a few weeks, until, finally, recovery set in.

In a child of two years I saw copious hemorrhages about the ear, groins, and neck with consecutive gangrene; in a boy of nine, extensive destruction of the skin over more than one-half of the abdomen; in both cases with final recovery.

The desquamation of typhoid fever may be quite copious and resemble that of measles or even of scarlatina. On the other hand, some of the eruption of the two latter may resemble the roseola of typhoid fever. That is why the

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diagnosis may become difficult, particularly as there are cases of which I have seen some, in which the latter and one of the former may be contemporaneous. Thus Cosgrave (*Brit. Med. Jour.*, Jan. 16, 1897), reports five cases in which scarlet and typhoid fever were coincident without seeming to increase the degree of danger. Both started at the same time.

From George M. Gould's American Year Book, 1898, p. 625, I quote Amitrano, who reports a case of typhoid fever developing in convalescence a scarlatiniform eruption with fever which was followed by desquamation. After this fever had subsided marked meningeal symptoms appeared for a few days. These disappeared, and after desquamation was complete a second intense erythema appeared, which was also followed by desquamation, after which recovery ensued.

Bones.—The bones suffer in different ways. The characteristic increase of growth after infectious fevers is mostly observed in scarlet, and in typhoid fevers. Epiphyseal and general pain about the extremities is frequent in typhoid fever, and some degree of epiphysitis is common, in consequence of this irritation. Periostitis and osteomyelitis have been observed, and bacilli have been found in the latter. Before the advent of the bacillus, I lost a child of four years with osteomyelitis of the right femur, in spite of early operation. Such cases are fortunately not frequent, but it appears they occur in from one to two per cent. of all typhoid fevers. Chondritis is still more infrequent, with less serious results.

Nervous System.—The nervous system of the young is believed not to be affected by typhoid fever, as it is in the adult. There are cases in which the general condition of the patient appears to be unusually good, compared with the toxic nature of the whole process, and with the height of the temperature. In many instances I concluded, from nothing but the apparent comfort and ease of the patient, when the high temperature would have suggested the presence of severe subjective symptoms, that everything but typhoid fever could be excluded. The same holds good of that in adults. In them ambulant cases are by no means

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rare, and those in bed often demand permission to get up, expressing the most complete satisfaction with their condition, while their temperature ranges at or above 104. Other children are apathetic, or somnolent, or peevish, and restless. The "typhoid state" should not by itself be taken as a symptom of typhoid fever. It may be absent altogether, and is found now and then when there is no typhoid. Headache is frequently complained of, or is betrayed by vertical wrinkling. Hearing may be bad, the conjunctiva injected and the cornea cloudy under the influence of the toxic disturbance of the trifacial nerve. Grinding of the teeth, sopor, or delirium, and vehement screams resembling those of meningitis, are occasionally met with. Such symptoms, though ever so severe, need not correspond with the elevation of the temperature at all; the latter may be rather low, while the intoxication is quite pronounced. Not every case of seeming cerebral or meningeal symptoms should be attributed to cerebral affection only; still, contractures, or convulsive movements may occur when there is an effusion from the pia mater. Such complications of genuine meningitis with typhoid fever certainly occur, and not only after the eighth or tenth year when gradually the typhoid fever in the young resembles more and more that of advanced age. Kernig's symptoms may be employed to clear up the diagnosis of genuine meningitis.

Some of the symptoms common to both may be explained differently. Vomiting may be due to the toxic degeneration of the cerebral substance, or to meningitis, or to the abnormal condition of the stomach, or even of the pharynx, or to nephritis. Coma or delirium I have seen in typhoid, in meningitis, also in cinchonism, and under the influence of salicylic acid.

As a consecutive symptom aphasia was found twenty times by Henoch; half a dozen times I have seen it in the course of many years; with the exception of one that suddenly died, probably of myocardial degeneration, all of them got well. Polyneuritis is not rare. In severe epidemics it is frequently seen, usually with a favorable termination. It is due to tissue alterations, occasioned by

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the influence of the bacillary toxin. Hemiplegia is rarely observed; a case of "cerebellar ataxia" in a boy of seven, which terminated in recovery, was reported by Luigi Conchetti, in *La Pediatria*, No. 8, 1898.

Paraplegia is more frequent, and still more so is local paralysis, under the influence either of the toxin, or of a hemorrhage, or of an embolus. Amongst them are paralysis of the glottis, which necessitated a tracheotomy in a case of Rehn's, and of the abducens (which I have seen in quite a number of cases, most of which were obstinate, some permanent) and of the accommodation muscles of the eye. Paralysis of the sphincter of the bladder is not infrequent.

Psychical disturbances are seen as the sequelæ of every infectious fever, mainly scarlatina and typhoid. Four such cases were reported by S. S. Adams to the American Pediatric Society in 1896. They may result from inanition, or from the parenchymatous tissue changes caused by the toxin, or from meningitis. Mania and melancholia are the two forms mostly met with. Not all of them terminate favorably. Two of my early cases died in lunatic asylums in rather advanced years. The motor disturbances not paralytic, which follow typhoid, particularly chorea, have all got well in my recollection, a few only with relapses. It struck me that post-typhoid chorea was less subject to recurrences than other forms.

I now give the particulars of two sets of observations, which will prove that the symptoms, course and complications of the typhoid fever of the young may greatly differ from one another, or from any average description of its nosology. One I published in the *Arch Ped.*, March, 1885.

The number of typhoid fever cases treated in the Children's Pavilion of Bellevue Hospital, from October, 1882, to September, 1884, was 25. Of these 11 were males, 14 females; 17 ran a single course, 5 had relapses, 3 were sick over a period of from four to six weeks, without permitting the second attack to be distinguished from the first by an alleviation of the symptoms. In seven cases a distinct chill was mentioned as ushering in the illness; in half a dozen more several attacks of chilliness were

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noticed. The ages of the patients ranged from 2 to 14 years, the average 9. Pain in the ileo-cecal region was complained of in fourteen cases, diarrhea was noticed in fifteen, bloody stools not amounting to hemorrhages in three; in three constipation was mentioned as a notable fact; in the first week of six epistaxis was observed. Tumor of the spleen was noted in sixteen; roseola was observed in fourteen cases. Its first appearance was noticed between the fifth and seventh day; it lasted from five to ten days. Premonitory symptoms were reported in nine cases; in four they lasted two weeks. They consisted in lassitude, loss of appetite, change of temper, and in some few cases, diarrhea set in a week before the initiating chill or chilliness. Five of my cases died; one remained stupid and hard of hearing for sometime, but recovered.

Contrary to my experience, as expressed in a lecture on typhoid fever (*Medical Record*, Nos. 17 and 18, 1879), in which I claimed a mild type and a low mortality for the typhoid fever of infancy and early childhood, this Bellevue service of mine had a mortality of 20 per cent.—similar to that of Cæsterlen, who estimated it at 22 per cent., and Friedrich, who reported 23 per cent., in children under five years of age.

In 1882 and 1883 we had a bad epidemic of typhoid amongst all classes and ages. The guests of summer hotels and boarding houses imported hundreds of cases, and the whole population suffered in consequence, infants and half-grown children as much as the rest, and the mortality all over the city was high. The hospitals have always more than their share, however, and their statistics must necessarily be erroneous. Errors are occasioned by the fact that with us at least hospitals do not contain the average cases, but as a rule those only who fare badly and promise badly. A poor family will nurse their children, while they require but little care; only that one which is seriously ill, and gives a great deal of trouble and a bad prognosis, is sent to the hospital. Of that class, many will die. That is why the mortality of a hospital does not indicate the general character of the epidemic. That is also why the general practitioner, singly or collectively, is the better

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judge and statistician. He sees all the cases in a family, those remaining at home, and those sent to a hospital; sees the mild and the severe cases, and counts those who survive. Six cases in a family, one of which is sent to and dies in the hospital, may give the family practitioner a mortality of 16, the hospital attendant one of 100 per cent.

Another series of observations was published by F. Sbrana (*Arch. de Méd des Enf.*, Jan, 1899). He reports on seventy-two cases of typhoid children, from 16 months to 8 years old, whom he observed in Tunis; 75 per cent. of all cases occurring in that sub-tropical city were in children; in one family there were four, in another three cases. Why there should be a prevalence of cases in children, is perhaps best explained by Jeannel's report made to the Fourth French Congress of International Medicine, in 1898. He observed an epidemic of typhoid fever, in which the communication may have occurred through the dust of the street into which the typhoid dejections were thrown. The principal and first sufferers were children who were playing in the street, and not very particular as to what they carried to their mouths. Both their size and their habits I counted many years ago and repeatedly since, amongst the causes of the frequency with which follicular angina, and also diphtheria are observed amongst the young.

The premonitory symptoms of the majority of cases consisted in anorexia, with headache, vomiting and constipation; the run of temperatures was quite irregular. In 50 per cent. there was epistaxis in the beginning; diarrhea began at a later period of the disease. Gurgling in the ileo-cecal region was not observed in patients less than three years old, and was altogether not common. Roseola was noticed in one-third of the cases, the spleen was enlarged in every one after the fifth or sixth day. There was no intestinal hemorrhage, and the fever disappeared by lysis. There was a furfuraceous desquamation in four cases; the mortality was 11 per cent.

There were many complications; suppurating parotitis in two; peritonitis from perforation, one; purulent pleuritis,

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one, with considerable dilatation of the stomach during convalescence; aphasia in five; orchitis of the left side without suppuration, one; and meningitis, three; two of the last terminated fatally. All these cases looked very much like cerebro-spinal meningitis; still there was the tumefied spleen, and no herpes. In other cases there were milder cerebral symptoms, such as dysphagia, partial convulsions, aphasia, and inequality of the pupils, without strabismus, or vomiting.

AGE, MORTALITY

Friedleben placed the greatest frequency of typhoid in childhood between the 5th and 8th year, Griesinger between the 5th and 11th, Lœschner and Friedrich between the 5th and 9th, Rilliet and Barthez between the 9th and 14th, Barrier between the 5th and 15th year, and Fauconnet between the 10th and 20th year. A few other figures contained with the above in *Gerhardt's Handbuch*, Vol. II., are as follows: Murchison noticed that 20 per cent. of all the inmates of the fever hospital were less than 15 years, Von Franque collected all the typhoid cases of the province of Nassau, and found 2021 of 11,028 to be less than 10 years, Gaultier gathered many French statistics, and reported 31 per cent. below 15 years. In a small town Baginsky counted sixteen cases under 10 years out of a total of 50, Rosenthal 28 in 115, Schædler 11 in 144.

Holt (Textbook, p. 1008) quotes 970 cases from eight authors; 8 per cent. were under 5, 42 per cent. from 5 to 10, 50 from 10 to 15 years old. Montmoullin (*Thèse de Paris*, 1885) reported fifteen cases under two out of a total of 295 under 15 years. Schavoir, in Stamford, Conn., collected 406 cases of all periods of life; of these 68 were under 5 years, 72 between 5 and 10 years. Morse reports 284 cases in the Boston City Hospital; 3 were under 5 years, 77 from the fifth to tenth, and 204 from the tenth to the fifteenth year. He also concluded that typhoid is unusual in infancy, because the Widal reaction was negative in two cases of simple diarrhea, forty-five cases of fermental diarrhea, and three of ileo-colitis, with the exception of one whose mother had typhoid fever years before. It will be seen, however, that in none of these

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cases the diagnosis of typhoid fever was made or suggested. As there was no typhoid there was no Widal.

All these figures and results are in confirmation of the earliest observations. Griesinger, for instance, wrote in 1857 (*Virch. Handb.*, II., 2, 124): "Typhoid fever is very rare in the earliest infancy; it is only from the second to the third year that the disposition becomes greater; after that time it grows rapidly, so that typhoid fever is quite frequent amongst us." (Germany.) Bouchut denies the occurrence of typhoid in the newborn. According to him it occurs first between the first and second year.

There are, however, well observed cases of typhoid fever in the newborn. Gerhardt quotes Charcellay who saw it in a child of eight days; Bednar, five days; Necker, thirteen days, and reports a case of his own at three weeks. I had a case, the mother having typhoid fever when the child was born. In the latter I diagnosticated the disease on the ninth day. There were a few spots on the epigastrium on the sixteenth day, a large and soft spleen, and Peyer's plaques swollen and rather soft, not yet ulcerated. The infant died on the sixteenth day of her life. C. P. McNabe (*New York Medical Journal*, Feb. 19th, 1898), observed typhoid fever, complicated with whooping cough and pneumonia in a baby a few weeks old.

The possibility of the transmission of typhoid fever to the fetus is beyond any doubt. Clinical experience proves such a transmission for typhoid fever, malaria, measles, scarlatina, variola and syphilis; also in erysipelas, relapsing fever, tuberculosis and sepsis. In young sheep anthrax was found as early as 1882; chicken cholera and glanders are transmitted in the same way. But it is possible that the epithelium of the placenta is a frequent barrier, and the suggestion of Malvoz's that the transmission of an infectious disease from the mother to the fetus takes place only when the villous epithelium is injured, I have always considered to be correct. He emphasizes the fact that of twins one may be affected while the other goes free. All these points are discussed by W. Fordyce in the *Brit. M. Jour.*, of Feb. 19th, 1898. The typhoid fever of the mother may destroy the fetus, may allow it to be born

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alive but weak, or alive and vigorous. Which of these results occurs depends on the amount of bacillary toxin transmitted or on circumstances unknown to us in an individual case. But the facts are firmly established. The fetal intestine was found diseased by Manzoni in 1841, Charcellay in the same year, Weiss in 1862. Bacilli were found in the fetus by Reher and Neuhaus in 1886; in the blood by Eberth in 1893; and the same results were obtained by Freund, Levy, Ernst, and Durck. Other good observations were made on the living child. The Widal test was found positive in a healthy infant 7 weeks old, that was born when the mother was in the third week of typhoid fever, by Crozier Griffith (*Med. News*, May 15th, 1897); and by Mossé (*Progrès Méd.*, March 13, 1897) in a newly born, whose mother had typhoid fever when in the sixth month of her pregnancy, and whose milk and placental blood gave the same positive reaction. Perhaps the case of Landouzy's will also prove the possibility of transmission though not through the placenta (*Soc. de Biol.* Nov. 6, 1897). A healthy baby showed a positive Widal test, while the woman had typhoid three months after confinement. As the baby had no other symptoms of typhoid fever, it is fair to suggest or to believe that transmission to a sufficient degree took place through her milk.

The transmission of typhoid bacilli into the fetus is demonstrated by a case reported by Etienne (*Gaz. hebdom.*, 1896, No. 16). A woman of 18 years expelled on the twenty-ninth day of her typhoid fever a fetus in the fifth month of uterogestation. In its blood taken from the right heart, the spleen, the liver and the placenta were typhoid bacilli, but no changes in the other organs. It appears that the death of the fetus resulted from the toxin which acted so rapidly that the organs had no time to participate in the process.

If, however, typhoid fever has been found by some in the fetus, in the newborn, in the nursling, there are those who never saw it at that age, and therefore are inclined to deny its occurrence.

In the *Arch. Ped.*, 1895, p. 916, Dr. W. P Northrup speaks of the results of 2,000 autopsies in children under

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5 years. Not one presented the lesions of typhoid fever. He also quotes Dr. N. Page of the Children's Hospital in Philadelphia, who says: "I have had from six to ten typhoid cases in children in the house constantly since I came on duty here, but not one of them was under 6 years." Dr. Ch. G. Kerley observed not a single case of typhoid fever among 1,326 children, 85 per cent. of whom were under 2 years, and 95 per cent. under 5 years of age; nor was a single typhoid lesion found in 410 autopsies. He adds that there was no case in the three years following his observations, under his successor in office.

Again, however, Steffen reports on 148 cases of typhoid in the young; 2 were less than 1 year, 26 from the third to the sixth, 34 between 6 and 9 years. Of Wolberg's 277 cases, however, the majority were as usual from 6 to 12 years old. Henoch reports on 9 cases below 2 years, 59 from 3 to 5, and 187 from 5 to 10 years, with a mortality of 12 per cent. He also reports of the finding of typhoid ulcerations 14 times in 26 autopsies. Ashby and Wright declare typhoid fever to be "not common under 3 years," while Rilliet and Taupin as early as 1840 pronounced it to be "not at all rare." About the same time Billard published his experience. According to him typhoid fever was rare in the first year, increased slowly toward the fifth, and was quite frequent between the fifth and fifteenth.

Maria Rivoire described an epidemic which reigned in Marseilles in 1896 and 1897 (*Thèse de Montpellier*, 1898). In and after May of 1897 there were 105 cases among children, of whom 21 died—20 per cent.; in 1896 43 cases with 15 deaths—31 per cent. Of 1270 cases collected during those two years there were:

Below 5 years						26, 6 deaths—23 per cent.
Between	5	and	10	years	59, 13 deaths—22	per cent.
"	15	"	20	"	289, 42	" —14.5 "
"	20	"	25	"	347, 63	" —18.5 "
"	25	"	30	"	262, 54	" —20.5 "
"	30	"	40	"	154, 25	" —17 "
"	40	"	50	"	30, 7	" —23 "

Above 5 years 10, no deaths.

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According to these figures the largest mortality occurred between the tenth and fifteenth year; the mortality of children below 5 or below 10 years equalled that of adults between the fortieth and fiftieth year.

H. Curschmann (*Nothnagel, Spec. Pathol. u. Therap. III.*) reports on 451 children (250 male and 201 female) observed with typhoid fever in the Hamburg Hospital between 1886 and 1887. Of these, seven were 2; nine were 3; sixteen, 4; eighteen, 5; thirteen, 6; twenty-two, 7; twenty-seven, 8; forty-four, 9; fifty, 10; fifty, 11; sixty, 12; seventy-one, 13; and sixty-four 14 years old.

Of Brouardel's 16,036 cases observed between 1880 and 1889, 36 were 1 year and under, 1,041 under 5, 1,265 from 6 to 10, and 1,386 from 11 to 15 years old.

According to an excellent report published by Dr. I. Rudisch, in the Mount Sinai Hospital reports (1899), on 974 cases of typhoid fever, which occurred from 1883 to 1898, 124 occurred in children below ten years, and 90 between the eleventh and fifteenth; a total of 214 cases. Of these one was six, another ten months of age. There were altogether below five years 37 cases, six of which died = 16.21 per cent., and 87 between the sixth and tenth, 7 of which died = 8.75 per cent. The exact figures for the first year were 5 cases with 3 deaths, for the second 6 with no death, the third 5 with no death, the fourth 10 with 1 death, the fifth 11 with 2 deaths, the sixth 16 with 2, the seventh 20 with 1, the eighth 11 with no death, the ninth 24 with 3, the tenth 16 with 1, and from the eleventh to the fifteenth 90 cases with 9 deaths.

One of the principal points made by Dr. Northrup is that the ulcerations claimed for typhoid fever are not characteristic at all; that, indeed, they are found in common intestinal diseases of non-infectious nature. That is what Hervieux contended thirty years ago, when he said that follicular swellings and superficial ulcerations in the intestines, and swelling of the mesenteric lymph nodes were found without any specificity in the morbid process.

This observation, and the assumption of uniformity in the nature of these ulcerations, was indeed the reason why in France for a long time the terms typhoid fever and

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dothienenterite were synonymous. But as early as 1877 C. Gerhardt emphasized the fact that the peculiar typhoid ("markige") infiltration and the formation of scurfs, which are mentioned now and then are distinctively different from the ulcerations of follicular or other enteritis. It is true, however, that in many cases there is a difference between the young and the adult. The changes in the plaques of the former are more hyperplastic (they are not so in enteritis), of the adult more necrobiotic. Nowadays the presence of the bacillus typhosus in and about doubtful ulcerations would furnish another positive diagnostic sign.

DIAGNOSIS

It is determined by the symptoms enumerated above, and while it is mostly easy in the adult, becomes more difficult in the very young. I choose to take it for granted that in doubtful cases the diagnosis of dentition and worms is nowadays confined to a certain class of illiterate women and obsequious practitioners only; but the differential diagnosis of the typhoid in the very young from a catarrhal fever, or influenza, or glandular fever, even from an intestinal auto-infection may remain difficult through many days—even for the skilled and thinking. The fever curve is very apt to be irregular, mainly in enfeebled children and in the presence of one of the many complications. There are even some cases in which the disease sets in suddenly with a high temperature; there are those, however, in which a high temperature is apt to be deceptive, for I believe with A. Fairbairn (*Jour. Am. Med. Ass.*, April 12, 1897) that the first symptoms may be overlooked for many a day. A cerebral pneumonia may exist half a week or more without being recognized, until the development of the disease and careful examination clears up the diagnosis. Influenza may assume the characteristics of typhoid to a certain extent. Meningitis may be recognized, if by no other symptoms, by means of a lumbar puncture and examination of the cerebro-spinal fluid. Altogether a rather slow pulse when not in proportion to the height of the temperature, the condition of the tongue, the swelling of

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the spleen, and the presence of roseola render the diagnosis secure even without the Diazo and Widal tests. In other instances, however, we arrive at a result by exclusion only. There is hardly a single clinical symptom which alone proves the presence of typhoid fever; the simultaneous presence of many is a more perfect guide. The diazo test is nearly conclusive when tuberculosis and pneumonia may be excluded; it may be expected to be positive in 90 per cent. of all the cases between the end of the first and the middle of the third week. The greatest difficulty is met with in those infants that yield few or no local symptoms except those of a septic infection only. Lymph nodes are sometimes found tumefied; their swelling in the inguinal region; however, from other causes is so frequent that, when found alone it should not count. The presence of herpes should generally be taken as proof of the absence of typhoid fever. The presence of the bacillus in the discharges would be the best symptom if we commanded a readier practical method for its discovery, provided there be other symptoms which make the case suspicious of being typhoid fever.

Much is naturally made of the presence of bacilli in the discharges of doubtful cases, and quite often the diagnosis had to depend on it. To what extent is that justified? There may be cases in which I should utterly refuse to accept the diagnosis of typhoid fever unless there be some one or more adjuvant symptoms, for the same reason that makes me refuse the diagnosis of diphtheria when there is nothing but the presence of Klebs-Loeffer bacilli, or that of tuberculosis when bacilli are deposited on some mucous membrane.

PROGNOSIS

The character and the mortality of typhoid fever are apt to vary according to seasons and epidemics. Baginsky places the mortality at 9 per cent., Montmoulin at 8.8, Steffen at 6.7, Hensch at 7.5, Wollberg at 4.7. In hospitals it is liable to be greater than in general practice for the reason that as a rule bad cases only are sent to public institutions. Still, in the Children's Hospital of

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Philadelphia there were 137 cases, three of whom died (2.66 per cent.); in the Boston City Hospital, the mortality in 284 children, under 15 years, was 6 per cent., while amongst 3,396 adults it was 13.5 per cent., and Holt collects 2,623 children with a mortality of 5.4 per cent. On the other hand, of Schavoir's (*New York Medical Record*, 1895) 192 patients (mostly in private practice), under 15 years, 2 died = 1 per cent.

Nurslings and the very young, also those approaching adolescence, are more endangered than those in the intermediate years, according to Roca (*Ann. de Policlin. de Bordeaux*, 1897), and Roemheld (*Jahrb. f. Kinderh.*, Vol. 48). High continuous temperatures are not always fatal, though they be complicated with a frequent pulse, nor are petechiæ absolutely ominous. A moderately slow pulse, and the occurrence of marked remissions are favorable, particularly when the fever is not terminated within three weeks. This continuation beyond the usual time is quite common in the very young, and when the case is apparently mild. A speedy recovery may be expected when the spleen gets smaller about the sixteenth or seventeenth day; if it remains large, the case will go on. Complications of any kind, pneumonia, meningitis, previous heart diseases, with feeble peripheral circulation (cold feet), laryngeal edema, hepatic or splenic abscesses add to the danger; that with malaria is not very dangerous provided it be recognized at an early time. Some of these complications are frequently called sequelæ; but as they share in the microbic etiology of the disease, they should be considered here. To this class belong erysipelas (mostly facial), otitis media, hematmata, which are sometimes very large and destructive to the implicated or superjacent cutis, arthritis, furunculosis, abscesses of all kinds, and occasionally an anemic dropsy, not attended with an affection of the kidney, the occurrence of which was noted by Griesinger nearly half a century ago.

Relapses are by no means rare, either after complete apyrexia, or with a moderate amount of remission about the end of the third week, or without any or much change in the temperature. They come after apparently mild, or

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after severe cases, without or with errors in hygiene or diet; when there was apyrexia, they were mostly of a shorter duration than when the fever remain continuous, or exhibited a slight remission only.

TREATMENT

The food should be liquid. My invariable rule is, with adults also, to insist upon that demand until apyrexia has lasted ten days. The patient should be encouraged to drink water frequently; the admixture of from eight to twelve drops of dilute hydrochloric acid to a tumbler full of water, or sweetened water, is a pleasant and disinfectant drink. Of albuminoids, peptones, and "peptonoids," and of beef-juice, only a certain quantity is digested or absorbed; the good that is to come from them is not from swallowing, but from digesting. The lips and tongue should be kept clean. Older children will wash and gargle. When the tongue is red and dry, and fissured, one or two daily applications may be made with a clean camel-hair brush, of a one or two per cent. solution of nitrate of silver. The nose should be kept clean, washed out with normal salt solution in urgent cases. To guard against hypostasis of the lungs and the cord, the posture in bed should be changed from time to time.

A purgative dose of calomel in the very beginning will act beneficially not so after the second half of the first week when diarrhea and hemorrhages may be caused by it. Constipation requires warm water enemata daily; diarrhea, frequent irrigations with water of from 95 to 100° F. When the discharges are offensive, thymol, or permanganate of potassium may be added in a proportion of 1:3,000-4,000. Internally, bismuth, sulpho-carbolate of zinc, salol, naphthalin are indicated. Bronchial catarrh demands no special treatment in most cases; if the secretion is viscid, and dyspnea present from that cause, camphor is serviceable. Collapse requires strong stimulants, by mouth and sub-cutaneously; diluted alcohol, camphor in sweet almond oil 1:4, and the salicylate or benzoate of sodium and caffen, soluble in two parts of water, answer best

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for that purpose. Insomnia, great excitement, and consecutive psychoses may require chloral hydrate. When the heart is feeble, croton chloral should be selected instead. When these symptoms are accompanied with heat of the head, cold applications to the head, ice water, ice bags are soothing. The head should, under such circumstances, be kept as high as comfort permits. Sopor or coma should be treated with cold affusions, while the body is submerged in water of 90 or 95 degrees.

Is it desirable to resort to antipyretic treatment? If so, in what class of cases, mild, medium or grave? This latter classification, however, should not exist, for the apparently mild case may turn out to be a grave one. Or is it desirable to allow high temperatures to persist?

The *vis medicatrix naturæ* has been eulogized in infectious fevers. However, the wholesome influence of intense body heat on bacteria and toxins has become very doubtful, and good observers like Flügge deny the new gospel of the increase of phagocytosis by high temperatures absolutely. Nor is the disintegration of tissues by heat alone successfully contradicted. Thus, after all, we need not enjoy the presence of high temperatures as a blessing, disguised or undisguised, and should reduce them. This much is certain, that the comfort of the patient is enhanced, and grave nervous symptoms alleviated, when the hot, dry skin becomes cooler and moist in proportion to the reduction of the general temperature.

Which are the means by which we can effectually obtain it? The number of antiferbrile medicaments has grown immeasurably; the cautious practitioner will do well, however, not to embark in the dark sea of unknown territories, guided by nothing but the flashlight advertisements of the drug manufacturer. Some of the new remedies are actual dangers. Acetanilid is a poison like all anilins; it changes hematin into methemoglobin, and thus cause the cyanosis that is so frequently noticed. Antipyrin is perhaps the safest; sodium salicylate annoys the stomach and the kidneys, which are very liable to suffer from the typhoid toxin alone. Quinine acts well during intermissions and remissions, not however when high temperatures are continu-

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ous. The cardiac stimulants—digitalis, strophanthus, spartein, camphor, alcohol—which improve the general and cutaneous circulation, and thereby the radiation of heat from the skin, are mighty weapons in the hands of the intelligent medical adviser, who moreover need not limit himself to the few remedies I mentioned.

All of these remedies, however, do not exhaust our resources; indeed they are only of minor importance. Without knowing all of it the old poet exclaimed "*hudos ariston*," the water is the best. Cold water and warm water are our most reliable and at the same time the safest antipyretics. Stress should be laid on the latter title, because many of the very apostles of hydrotherapy, perhaps influenced by shaky phagocytosis and toxin theories, belittle it in comparison with the nerve stimulating powers of water. Now, cold bathing is frequently contraindicated; it is not borne when the heart is feeble from whatsoever cause; for instance, long duration of the disease, complications with pneumonia, peritonitis, or hemorrhages, previous bad health or, in the adult, excesses. No stimulant given before or during the procedure is certain to counteract the paralyzing effect on the peripheral circulation. When after a cold bath the feet remain cold and the pulse small, the bath was contraindicated, and did harm. The patients in public hospitals are quite often of a low vitality, and feel the cold bath as a shock; at all events, most of those who arrive in the hospital after a week or two have passed the time when the cold bath might have done good. Of this nature is the latest experience of I. Rudisch in the Mount Sinai Hospital (Mt. S. Rep., Vol., 1899). He says: "The Brand treatment reduced the mortality a little over 2 per cent. This reduction occurred in the cases which had been sick two weeks or longer, outside the hospital. Since the introduction of the Brand treatment there has been an increase in the number of cases of pneumonia and phlebitis, and a decrease of those of furunculosis and nephritis. Relapses have increased 2.5 per cent. The death rate in the relapse cases before and since the introduction of the Brand treatment is practically the same. It has not reduced the number of complicated cases as a

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whole, but has decreased the number of deaths from toxemia in the causation of the mortality of typhoid fever."

This does not speak well for the indiscriminate use of cold water for hospital patients.

The dangers of cold bathing are not encountered in warm bathing. This is not the place to prove for the thousandth time that a bath of 95° or 90° F. when of sufficient, even when of short duration, will reduce a temperature of 104° or 106°. It is simply a fact. Such a bath may easily be given every three or five hours; even apparently mild cases should have two or three daily, from the beginning to the end of the illness. They reduce the temperature, the accompanying frictions stimulate the cutaneous and general circulation, the general condition is improved, the so-called typhoid state relieved, and relapses become less frequent. Warm bathing should be the principal treatment of all typhoid fevers, not to the exclusion, however, of occasional medication calculated to have similar effects. The combination of frequent and protracted bathing with proper medication will always remain appropriate, though our resources should, as we expect, be increased by serotherapy. The searching for it, and the frequent insufficiency of medication in skilful or unskilled hands, both by thoughtful or routine practitioners, have caused us too often to neglect our most active helps. Even where serotherapy has scored its most deserved laurels, for instance, in diphtheria, the almost boastful limitation to the use of antitoxin, to the exclusion of other internal and external treatment, is a mistake. What is to be treated is not the bacillus, but the organism invaded by the bacillus; and the clinician should know that bacteriology is an indispensable aid to clinical medicine, but not clinical medicine itself. Thus, when we shall find an antitoxin for the typhoid bacillus, we shall still require adjuvant treatment for the typhoid man, woman and child.

ANÆMIA IN INFANCY AND EARLY CHILDHOOD

PATHOLOGICAL processes are but the utterances of physiological functions performed under abnormal circumstances. Those functions depend on the anatomical condition of the tissues or organs. While this relation has long been established in the minds of medical men, the former, though acknowledged theoretically, is frequently not heeded. As a rule, the pathological anatomy of a diseased organ is stated, in connection with the history of a case, or the description of a class of cases, but the reference of an anatomical predisposition of tissues or organs to special morbid processes is mostly neglected. It is mainly Beneke who has studied disease from this point of view, and it is from his various essays and works on kindred subjects that some of the exact data to be laid before you are taken.

By rights, every treatise, essay or paper on a pathological subject ought to commence with the normal anatomical condition of the organ or tissue to be dealt with. Thus, only, an intelligent appreciation of the facts becomes possible, and thus, only, when every case is viewed in this light, the practice of a medical man is raised above the level of routine and drudgery.

When, some time ago, Mr. President, I had the honor of reading before our Society a paper on infant diarrhœa and dysentery, I emphasized the fact that healthy infants have a normal tendency to loose liquid or semi-fluid evacuations from the bowels. The causes I stated to lie partly in the conditions of the intestinal tract, and partly in the nature of the normal food, viz., breast milk. The latter do not concern us now, but the former I repeat merely for the purpose of establishing, in a few examples, the close connection between anatomical structure and physiological

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and pathological conditions. The peristaltic movements in the infantile intestine are very active; the young blood-vessels very permeable; the transformation of surface cells is very rapid. The peripheric nerves lie very superficially, more so than in the adult, whose mucous membranes and submucous tissues have undergone thickening by both normal development and morbid processes. In the infant, the peripheric ends of the nerves are larger in proportion than in the adult, the anterior horns of the nerve centres more developed than the posterior ones. Thus, the great reflex irritability of the young, under intestinal and other influences, is easily explained. Besides, the action of the sphincter ani is not quite powerful, the fæces are not retarded in the colon and rectum, and no time is afforded for the re-absorption of the liquid or dissolved constituents of the fæces. Moreover, the frequent occurrence of acids, sometimes in normal conditions, in the small intestines, gives rise to the formation of alkaline salts with purgative properties.

On the other hand, constipation in the very young is sometimes the result of grossly anatomical conditions of the intestinal tract. I should not have to allude to the fact at the present time if it were not for the following reasons: Firstly, this form of constipation illustrates exceedingly well the connection between anatomy and function; secondly, the routine treatment of constipation by the administration of purgatives would be very dangerous in just such a case; and lastly, what I have published about the subject more than ten years ago, and repeated in the treatise on hygiene, edited by Dr. A. Buck, appears not to have been noticed to such an extent that the suffering infants can be sufficiently benefited. At least, in an essay on constipation, published but lately and presumably considered complete in its etiology, this important cause of the most obstinate form of constipation in the very young is not mentioned at all.

It therefore bears repetition; it is, in a few words, as follows: Until the fourth or fifth months of foetal life, there is no colon ascendens, and it is still short at birth. Notwithstanding that fact, the large intestine at birth

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is comparatively longer than that of the adult. While in the infant it is nearly three times the length of the entire body, it is but twice that length in the adult. Now, the colon ascendens is very short in the newborn, the transverse colon is not much longer; thus, the main part of the excessive length belongs to the colon descendens, and mainly to the sigmoid flexure, which Brandt found from fourteen to twenty centimetres, and myself in one case thirty cm. in length. This exorbitant length of the sigmoid flexure at the entrance of the narrow pelvis, gives rise to more than the simple curve found in the adult. Not infrequently the main curve is found on the right side instead of the left, and sometimes the repeated bending upon itself of the elongated gut is such as to seriously retard, and in a few instances prevent, the passage of fæces.

The two instances hitherto spoken of illustrate the close connection of two conditions noticed in very early life depending upon the anatomical structure of the affected organ. In brief, I shall allude to two others which become manifest at a little later period of infant life. Thus, in rhachitis, while the heart is of average size, the arteries are abnormally large, the liver is of extraordinary volume, and the lungs are small. Great width of arteries lowers the pressure of the blood. One of the results of this physiological fact is the murmur audible in the brain of rhachiticial babies, which, by no means, as Jurasz explained it, results from the anomalies of the carotic canal. Another result of the low blood pressure is the retardation of the circulation in the muscles, and more yet about the epiphyses, which swell and soften. It is not the growth of the epiphyses alone which, by itself, results in general rhachitis, for the epiphyses are still in their cartilaginous condition up to adolescence, and some do not ossify until the twentieth year of life; but no rhachitis is met with at this advanced stage. Thus it is by no means the anatomical condition of the cartilaginous tissue which is one of the causes of rhachitis, but the condition of the arteries supplying the epiphyses. Besides, the large size and active condition of the liver give rise to a copious formation of

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cholestearin, the importance of which, in the establishment of a hyperplastic condition of cartilage cells and tissue elements in general, has long been recognized. Thus, ossification becomes irregular and defective, and the rachiticial bone contains an abnormally large quantity of fat, in contrast with the deficient percentage of lime, which either is not introduced or not assimilated in consequence of the faulty nature of the preliminary stages of osseous development.

Some other peculiarities are found in the condition which has been called scrofula. The normal relation of the heart to the lungs, between the second and twentieth years, is 1:5-7; in scrofula it is 1:8-10. This circumstance, coupled with an acquired debility of the nervous system, results in an insufficient supply of blood to both lungs and organism, and defective oxygenation, particularly in those cases which by common consent have been called torpid scrofula. It is mainly in these that the lymphatic system pre-eminently participates in the symptoms. The size and number of the lymphatics are very great in infancy. Sappey found that they could be more easily injected in the child than in the adult, and the intercommunication between them and the general system is more marked at that than any other period of life. These facts are but lately verified by S. L. Schenck, who, moreover, found the network of the lymphatics in the skin of the newly-born endowed with open stomata, through which the lymph-ducts can communicate with the neighboring tissues and cells, and *vice versa* (Jacobi, "Treat. on Diphth.," p. 31).

The blood of the newborn differs greatly from that of the infant at a period but little advanced. The hæmoglobin in the umbilical artery amounts to 22.2 per cent. of the whole solid constituents, while in the venous blood of the mother it is but 13.99 per cent. The first to prove this high percentage was Denis, in 1830, who found the correct proportions by determining the quantity of iron contained therein. Poggiale found a similar proportion of the hæmoglobin in the newborn and the fully-grown dog, viz., 16.5:12.6 per cent., and Wiskeman's results are similar. The total amount of the blood contained in

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the newborn is, however, smaller than in the adult, the relation of its weight to the total weight of the body being in the former, 1:19.5; in the latter, 1:13.

These conditions, however, are being changed soon. The high percentage of hæmoglobulin commences to decrease instantly. Young animals have less than old ones; in the calf and oxen the proportion is 11.13:13.21.

Denis found it to diminish until the age of six months, and a very slow increase up to the thirtieth year. Leichtenstern found the following proportions: if the blood of the newborn contains hæmoglobulin 100, that of a child of from six months to five years contains 55; of from five to fifteen years 58. At the age of from fifteen to twenty-five it is 64, 25-45=72, and 45-60 it is 63. Subotin also found less in young animals than in old ones; also less when the amount of nitrogenous food was reduced. Leichtenstern found the percentage of hæmoglobulin to decrease in the very first two weeks. It was lowest at the age of from six months to six years; after that time a slow increase takes place. But even in the very vigor of life, in the third and fourth decennia, the percentage of hæmoglobulin is smaller than in the newborn.

There are some more differences in the composition of the blood of the young, more or less essential in character. The foetal blood and that of the newborn contains but little fibrine, but vigorous respiration works great changes in that respect. Nasse found the blood of young animals to coagulate but slowly. How this is in the infant cannot be determined until more and better observations will have been made. There are less salts in the blood of the young, and according to Moleschott, more leucocytes. Its specific gravity in the young is 1045-1049; in the adult, 1055. Thus, letting alone the newborn, the result from the above figures is this: The infant and child has and requires more blood in proportion to its entire weight, but this blood has less fibrine, less salts, less hæmoglobulin, less soluble albumen, more white blood corpuscles, and less specific gravity.

The large arteries in the newborn and the infant are wide, and consequently the blood pressure is but low. This

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is mainly so in the first five years, in the subclavian and common carotid. Thus the brain has a chance to grow from 400 grammes to 800 in one year; after that period its growth becomes less. At seven, boys have brains of 1100, girls of 1000 grammes. In more advanced life its weight is relatively less; 1424 in the male, and 1272 in the female. At the same early period the whole body grows in both length and weight. The original 50 cm. of the newly-born increase up to 110 with the seventh year; the greatest increase after that time amounting to 60 (in the female, 50) centimetres only. In the same time the weight increases from 3.2 kilo. to 20.16 in the boy; from 2.9 to 18.45 in the girl; a proportion of 1 to 6 or 7, while after that time the increase is but three- or four-fold.

As the organs grow, so do the peripherious blood-vessels. Their size is in proportion to the large blood-vessels. Only the heart grows toward the seventh year, perhaps, only because it requires an over-exertion to overcome the sluggishness in the circulation of the large and small blood-vessels. It is smallest, with large arteries, in the first year (particularly in the second half) at the same time that the growth is most intense. Thus it appears that the growth and physiologically low blood pressure go hand in hand.

The sizes of the large blood-vessels do not grow equally, nor do they exhibit the relative proportions to each other of the normal development of the adult. The pulmonary artery is from two to four centimetres larger than the descending aorta. That means for the lungs more active work, but also more tendency to disease, particularly as, since the closure of the ductus Botalli, the aorta, from which the bronchial arteries are sent off, assumes considerable proportions within a short space of time.

At this time the lungs begin to rival the liver, which in the first days of life was twice as large as both lungs combined. At this time, the amount of carbonic acid eliminated by the lungs is increasing steadily to relative proportions not known in the adult, in the same manner as the amount of urea eliminated is relatively larger than in

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the adult, in consequence of the size of the kidneys, which are proportionately larger than in the adult.

Water prevails in the organs, even to a greater extent than the smaller specific gravity of the blood appears to justify. The brain in all its parts, but not equally in all, contains a high percentage of water, the exact figures of which can be found in "Buck's Hygiene," 1st vol., p. 139. The muscular tissue has a percentage of 81.8 (E. Bischof) in the newborn; of 78.7 in the adult. Schlossberger found the following figures: in a calf of four weeks 79.7; the grown-up animal, 77; the young duck, 85.4; the old 72.

The labor required of both heart and lungs is greater than in the adult; thus fatigue is more easily experienced, and the necessity of sleep, the interruption or absence of which adds to the exhaustion and waste, is readily explained. More physiological work is done by these two organs, and, moreover, in a manner somewhat different from what we notice in the fully developed individual. In him, nothing is required but the sustenance, or rather, constant reproduction of the bulk of the body; in the child, not only reproduction, but a new development of tissues, a constant growth, must go on.

Within one year after birth, the young creature attains three times its original weight. Thus we have to deal with a being whose organs are in constant exertion, or almost over-exertion. Now, metamorphosis of matter is not controlled by the inhaled oxygen alone, for the living organism is not only what Liebig took it to be, an oven; its intensity depends certainly in part on nerve influences. As the nerve cells contain so much more water than in later periods of life, it is very probable that their electro-motor action differs from that exhibited later on. Besides, the predominating development of the medulla oblongata, the anterior horns and trophic nerves, points to the same conclusions. All this action and activity is at the expense of the system. But that is not all. Not only exertion and almost over-exertion, when compared with the efforts of the merely self-sustaining adult system, but constant production of new material, and all this at the expense of a blood which contains less solid constituents than the blood.

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of the old. Thus the normal oligæmia of the child is in constant danger of increasing from normal physiological processes. The work before a baby has to be performed, under the most favorable circumstances, with, so to speak, a scarcely sufficient capital. The slightest mishap reduces the equilibrium between that capital and the labor to be performed, and the chances for the diminution of the amount of blood in possession of the child are very frequent indeed.

Thus, the vulnerability of the young being great, and diseases in early infancy and childhood so very frequent, cases of anæmia are met with in every day's practice, and in every form, complicated and uncomplicated, with great emaciation or without it, and either curable or not. A condition so frequent, so variable, so dangerous, deserved to be treated in monographs by the best men amongst practitioners and writers, and still there is scarcely any text-book, any journal, in which a competent and comprehensive view of the subject can be found. There is but one noteworthy exception to this fact. Dr. Förster, of Dresden, contributed two years ago a valuable essay on the subject in one of the most praiseworthy literary undertakings of modern medical authorship. There are two great works in pædiatric literature recognizable as landmarks. The first were the three volumes of monographs published by Rilliet and Barthez. The second is the great manual on diseases of children, edited by C. Gerhardt. In its third volume Dr. Förster's article has been published. Like others before him, he makes a distinction between idiopathic and symptomatic anæmia.

The former diagnosis is made when there is no tangible cause at all, or none which still persists; the latter when the change in the blood, with all its consequences, is attributable to a previous or present sickness. Perhaps it is idle to consider the question at all, whether there can be a genuine, primary idiopathic anæmia. When we sift the matter, we shall come to the simple conclusion that everything has its cause, is but a result, and secondary to something else. From this point of view, and strictly speaking, objection could be raised to the term idiopathic pneu-

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monia, peritonitis, or meningitis. When we make use of it, we mean to state only that the local affection is no longer complicated with any other that could be diagnosed, and, possibly, removed.

In this sense there are cases of idiopathic anæmia, in which the original infant disposition to it, of physiological character, has been raised to a pathological dignity. But the large majority of cases are of markedly secondary character, and cannot be appreciated or treated rationally without the recognition of the original causes. They are of the most various character. In fact every disease occurring in infancy and childhood may give rise to anæmia. Very few diseases when they have run their full course and terminated in what we are pleased to call recovery, leave the organism or the affected organ in as perfectly a normal condition as previously. The frequent recurrence of simple diseases such as pneumonia points to the fact that changes have been worked which create a constant predisposition to pathological processes in the same organ. Thus, in most cases of anæmia the diagnosis of the whole case must extend to the organ first affected, and the treatment, while it may be directed against the result, is incomplete unless the causal indications be fulfilled.

Hemorrhages result in anæmia in a number of instances. They are of different character and importance. There is true melæna; umbilical hemorrhage; hemophilia; primary or secondary purpura; internal hemorrhages of the newborn; cephalhæmatoma; hemorrhages from rectal polypi; epistaxis depending on coryza; epistaxis at a more advanced age from heart disease and abdominal stagnation; hemorrhages in diphtheritic angina; and such as take place during or in consequence of operations for hare-lip or ritual circumcision. Death may result from many of them, such as melæna, hemophilia, pharyngeal hemorrhages, or circumcision; others are of but little gravity, such as the sanguineous tumor of the newborn; others are apt to result in permanent ailing. As a rule, however, an acute anæmia is more easily overcome than one that is of a more chronic nature, and thereby undermines the vitality

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and strength of the organs while it slowly robs them of their nutriment. Infants who are thus stricken recover but slowly or not at all. Young animals resist starvation to a less degree than old ones. A dog of two days bore starvation in Magendie's laboratory but two days; a dog of six years, thirty. Similar results were obtained by Chossat in his experiments on pigeons. Thoroughly anæmic and delicate babies seldom recover entirely, like starving young animals which never attained their normal condition though they were carefully fed afterward. The recruits of the Prussian army born in the starvation years of 1816 and 1817 were of a very inferior character physically. To this class also belong the children born prematurely and of delicate parentage, though there were no recognizable constitutional disease, and of mothers afflicted with a disease of the uterus or placenta, inflammatory, syphilitic, or otherwise; or of such as suffered much during pregnancy or lactation; also those born with congenital diseases, cyanosis, or neoplasms, which are by no means so rare as has often been believed and said, or the peculiar smallness of the heart, and principally the arteries, to which Virchow attributes many cases of chlorosis. I have met with half a dozen of such cases, in which the supply of blood to the body was diminished by this anomaly, and Dr. Skene reported a case of probably the same nature which was published in the *Journal of Obstetrics and Diseases of Women and Children*, Oct., 1876.

Besides the diseases and affection of the newborn there are others which develop in later life and lead to the same results. It is often acquired in endocarditis, for instance; acute inflammatory rheumatism, which is very frequent, yields in most cases but little swelling of the joints, comprises most cases of so-called growing pain, and has a much more marked tendency to the production of an endocarditis than the same affection in the adult.

Protracted diarrhœa injures to a greater extent than constipation. It acts not only by direct and immediate loss of serum, through which it can prove fatal in a short time, but more frequently by its consequences. The mucous membrane of the intestinal tract becomes thick-

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ened, the submucous tissue œdematous, the muscular layer œdematous or hyperplastic; the adventitia sometimes undergoes fatty degeneration. Erosions and ulcerations are apt to become chronic, and frequently the mesenteric glands are the seats of congestive and hyperplastic processes. An intestinal catarrh cannot last any length of time without irritating, congesting, enlarging, and finally indurating, or provoking caseous degeneration of the neighboring lymphatic glands. The cause of the diarrhœa is indifferent in this respect. None can last without consecutive injury to the lymphatic glands which is apt to become permanent and deteriorate sanguification for the future. The unmistakable practical conclusion from this fact is that every diarrhœa must be stopped as soon as possible. Neither summer heat, nor that great scapegoat—dentition—must be permitted to yield a pretext for the continuation of a diarrhœa, no matter how innocent it may appear.

Malaria, which is too often diagnosticated when the real nature of the disease is not recognized, and frequently overlooked because of the irregularity and the little pronounced character of the attacks. The first stage of the attack is often not recognizable. The attacks are apt to come at irregular times; are more quotidian than tertian, often concealed by accompanying symptoms such as convulsions, and, therefore, sometimes not accessible to a ready diagnosis. On the other hand, the influence of malaria is apt to undermine the general health, render the child intensely anæmic, and swell the spleen considerably before ever giving rise to a real attack.

Nephritis, with albuminuria, not the acute cases, but those chronic ones which slowly undermine the nervous system and exhaust by direct loss; pernicious anæmia, with, it is true, as far as I know, but two cases occurring in children, recorded in the literature of this recent subject; leucocythæmia; sleeplessness from any cause such as malaria, whooping-cough, or indigestion; mercurial cachexia, rare though it be; congenital or hereditary syphilis; rhachitis, with its influence on blood glands and bones, its shortening, flattening and even retraction of the thorax,

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its curvature of the spine, and compression of the lungs and heart; fatty liver; enlargement of the lymphatic glands, mesenteric, bronchial or otherwise; the complex of symptoms comprehended under the general head of scrofula; diseases of the bones of the most various kinds, from congenital or premature ossification of the costal cartilages, with its consecutive contraction of the chest and compression of its contents, to the chronic or subacute osteitis of the vertebral column or any of the other parts of the skeleton, with its final termination in amyloid degeneration of the viscera; and finally, to conclude with, diseases of the lungs and pleuræ, caseous deposits, cirrhotic induration, emphysema and empyematic deformity.

In anæmia both the skin and the mucous membranes are pale, of a yellowish hue, thin and flabby. A certain degree of apparent elasticity of the skin and subcutaneous tissue is noticed only in cases of œdematous effusion. Those organs or tissues which are least in use emaciate first; that is, in very young children, fat and muscle. But there are cases in which fat is persistently retained, and in which it is often increased in quantity. For, when the red blood globules are destroyed, there is scarcity of oxygen, and for that reason the combustion of the albuminous substances becomes incomplete, and fat, the physiological result of this incomplete combustion, is deposited in large masses. Particularly is this the case when anæmia is either complicated with or is the result of general rhachitis—when at the same time the glands and the chest are suffering from the results of the rhachitic processes. An illustration of this peculiar occurrence, which is by no means rare, is also seen in the peculiar appearance of acardiac or acephalic monsters, which contain a large amount of œdematous fat, in consequence of the exclusively venous character of their circulation.

In consequence of the ill nutrition and the emaciation of the muscular tissue these infants and children are easily fatigued. In general, the functions of all the organs suffer considerably. And with such debility, irritability goes hand in hand. The nervous system is less affected than any other, because of the rapid growth and development

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which it undergoes at that period of life. Not infrequently, babies who are anæmic and emaciated are in the very best of spirits, because their brains are comparatively in good condition. A certain amount of emaciation can be easily recognized by the depression of the fontanelles of babies under one year old or even later; but the emaciation of the brain does not increase at a rate which corresponds with the loss in weight of the other organs and tissues of the body. In addition, the very sinking in of the fontanelles, which allows us to estimate the amount of emaciation that has taken place inside of the cranial cavity, leads us to the fair conclusion that the emaciation of the rest of the body has taken place to an unusual extent; and any baby with considerable depression of the fontanelles must be considered in danger from the degree of inanition present.

Murmurs in the jugular veins are not very frequent in infancy and early childhood. Murmurs in the carotids and over the large fontanelles, however, are not at all rare. It is not true that these murmurs, audible over the brain, belong to rhachitis alone. They are found in every condition in which blood pressure in the large arteries of the cranial cavity is lessened.

The heart itself seldom exhibits functional murmurs. Whenever they are present, it is safer to attribute them to organic disease than to merely functional disorder. Besides, it is now well known that acquired endocarditis is by no means rare, and, moreover, that it occurs even more frequently in the articular rheumatism of the young, be it ever so slight, than of the adult. Although the brain be not so liable to suffer from emaciation, dependent upon anæmia, as other organs, still there are a number of cases in which headaches, attacks of syncope, sleepiness, etc., or, on the contrary, sleeplessness and hysterical attacks, are the result of anæmia alone, and disappear when this condition is relieved. Not a few of the babies and children who cry the greater part of the night have no other ailment besides general anæmia, and such children are frequently relieved by a meal or some stimulant before they are put to bed, or given during the interruption of their

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sleep. The pulse of such children is sometimes very much accelerated; sometimes, however, it is slow, and sometimes irregular. I have known such children, in whom for months, and occasionally for years, I have feared the development of cerebral affections from the very fact that their pulse was both slow and weak; and yet, when their general condition was improved both the regularity and frequency of the pulse were increased.

The pulse, however, is, perhaps, amongst the symptoms which are most unreliable at this age. In the baby it is best counted during sleep, and better over the fontanelle than upon the radial artery. It will change very frequently, not only with alternate sleeping and waking, with rest and restlessness, but sometimes without apparent provocation. A slight amount of muscular action will change its character more or less, and frequently considerably. Physiologically, the pulse is very apt to be more frequent at the age of two and a half or three months than earlier or later, because it is at about that age that muscular movements are actually developed.

Very few anæmic children have a good appetite except at the beginning. The influence of anæmia is general in regard to all organs of the body. Circulation is deficient, and the normal secretions are defective or deficient in consequence. That is, both appetite and digestion are impaired, and sometimes destroyed, and cannot be restored until the general condition of the child is improved.

The slowness of the circulation and its insufficiency, and the watery condition of the blood, are apt to give rise to catarrh of the pharynx and larynx and the respiratory organs in general. Besides, the walls of the blood-vessels are known to suffer in anæmia. They become thin, and undergo fatty degeneration, which Ponfick has found in the heart, and in the intima of the larger blood-vessels and in the capillaries. In consequence of the thinness of the blood and the changed condition of the blood-vessels, serous transudation, and, now and then, extravasations will take place. The same occurrence is noticed in the adult in conditions of anæmia. It not infrequently occurs that those who have least blood lose it most easily. Anæmic

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women are very apt to have copious menstruation, and when their general condition has been improved, both blood and blood-vessels resist this tendency to hemorrhage.

There is one consequence of the anæmic condition which is of the utmost importance, and requires urgently that it should be removed in the shortest possible time.

Whenever a disease sets in it is more liable to result fatally in consequence of impaired powers of resistance, and where there is the slightest tendency to effusion or to exudation these processes will become more extensive and dangerous in less time than in the normal organism. A pneumonia, a peritonitis, a pleurisy, occurring in an anæmic child, is attended with a great deal more danger than when either of these affections occurs in a child enjoying good general health.

That epistaxis in a child 5, 6, or 8 years old should last as long as the patient is in a generally impaired condition, is just as frequent an occurrence as it is a common experience to meet with almost constant improvement after a change of diet, change of air, and a few doses of iron.

The predisposition to anæmia in the child is very great, as proved before, and the causes of its development very numerous. These causes must be, according to circumstances, either prevented or remedied. For genuine cases of idiopathic anæmia are certainly very rare, and an accurate diagnosis will find it to be symptomatic in almost every case, and to depend on the lesion of some organ, or system of organs. The danger of anæmia is greatest at the time of the most rapid growth, still it is a cause of slow destruction in every age. The nursling is more exposed than the child, for the growth of all the organs, with very few exceptions, is most intense at the earliest period of life. At that time, besides actual disease, insufficient food, or improper food, are frequent causes, the latter a more frequent one than the former, and often the more dangerous one of the two. Infants whose mothers or nurses have not enough milk, simply starve; they lose weight, strength and color. As long as their lungs and muscles will hold out, they will scream. Some of the yell-

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ing heard in the night amongst the tenement-house population, and sometimes in the better-situated classes, too, comes from starving babies. After a while the yelling turns into a whining, and any slight disease terminates the baby's suffering. This condition is recognized by the absence of local disease anywhere, by the gradual emaciation, and is characterized by the paucity of otherwise normal fæces. Many a case of alleged constipation is one of starvation. Where there was no food, there are no evacuations, and when a baby is reported as having but one normal passage a day, or even less, the suspicion is that it has not enough to eat. The remedy is easily recommended, for it consists in nothing but a sufficient quantity of proper food.

Improper food is a much more frequent cause. A few remarks must suffice here, for it is impossible to go over the whole ground of infant hygiene in a short paper which is more meant to suggest than to teach. A few points, however, I must not omit, because of the frequency of the sins committed. The contraindications to a woman's nursing a baby must be obeyed. Nursing during pregnancy, or extended over too protracted a period, must be forbidden. The latter is, if possible, more serious than the former. Many a case of rhachitis or anæmia owes its origin to the baby being nursed into the second year. A baby whose development is not normal, for instance, whose first tooth does not appear at the regular age of seven or eight months, is either suffering from a previous disease of it has insufficient or improper food. If nursed, therefore, it ought to be weaned, or partially so. Many a flabby child at the breast will thrive when weaned at last, and good barley and cow's milk will make better muscle and teeth than poor mother's milk. An inherited or inheritable or communicable disease on the part of the mother or wet-nurse, such as consumption, rickets, syphilis, serious nervous diseases, intense anæmia forbid nursing. In not a few cases the individual milk of mother or wet-nurse does not agree with the baby. When such is the case, unless the fault can be detected and remedied, weaning is required. In most cases it is possible to trace the

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indigestibility and insufficiency of a mother's milk to the absence or prevalence of a special constituent, mostly either sugar or—and mainly so—casein. A beautiful illustration of this fact was but lately exhibited by a baby patient of Dr. A. N. Smith. The mother's milk was undoubtedly too white and too caseinous. The baby's digestion was faulty, his assimilation quite defective. The addition of some farinaceous decoction to each meal from his mother's breast—a few teaspoonfuls given before each meal—remedied the evil somewhat, but the patient's life was finally saved by nothing but weaning and exclusive artificial feeding. It is impossible, however, to consider now the question of infant food to any extent. Such principles as I have laid down in Buck's Hygiene, and very briefly in my paper on infant diarrhoea and dysentery, have guided me through the better part of my life. I shall not, therefore, tire your patience by repeating them. There are, however, a few simple words which I cannot repeat too often. Avoid solid food in the care of an infant. Avoid cow's milk either undiluted or diluted with water only. Avoid condensed milk diluted with water only. Use no milk without the addition of some gelatinous or farinaceous decoction, barley, oatmeal, gum arabic, gelatine. In anæmia, add beef soup to the uniform infant food daily. Give solid food, that is a small piece of meat, a crust of bread, half an egg, about the end of the first year. Keep up this simple diet for another year, and add slowly such articles of food as physiology and experience permit. Prohibit bad habits, such as irregular and fast eating, cold feet and highland-fashion legs, and enforce out-door exercise; children before and after an out-door play are different beings. Avoid crowded school-rooms and the excess of private lessons. A child sleeping after a healthy exercise of his muscles and lungs will finally, besides being stronger and healthier, learn more than one who hangs his pale cheeks, sleeping over his books. We have laws to protect children from being sent to work in factories, or to be employed on the stage, but we have none to protect them from the equally destructive, incessant schooling in close rooms, without air or exercise.

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There are too many books bought for Christmas and too few skates.

Amongst the medicinal agents iron has long been the main resort in anæmia and chlorosis. This was so even before the time when hemoglobin was isolated and found to contain all the iron of the blood. As it was found to benefit the cases of anæmia and chlorosis, in which the red blood corpuscles were undoubtedly diminished, it was believed that iron had the ability to directly increase the number and the quality of the red blood globules. But the question whether it is really the iron which produces this effect has not been answered to the satisfaction of all, for a great many of the cases get well while no iron whatever is given, and in consequence of change of diet and the securing of rest and a better general condition. Besides, there are a number of cases in which the administration of iron is absolutely unavailing. Moreover, there is plenty of iron in almost every article of food. Boussain-gault found that thus eight or nine centigrammes (gr. iss.) of iron are daily taken into the body. The same quantity has been found by Fleitmann to be eliminated by the kidneys and the intestinal canal. Thus, there certainly are cases of chlorosis which have not been caused by the absence of iron; and it cannot, therefore, be said that the iron, by supplying this lack or by removing this absence, cures chlorosis.

But it is still a question whether the iron thus given, under circumstances which are entirely abnormal, does not improve the chances of recovery in just these conditions. The doses given would certainly be too large, when compared with the iron contained in the food and with the amount of iron present in the whole quantity of circulating blood, three grammes and no more.

Compared with this small quantity, the doses we are accustomed to administer are certainly large. Speedy elimination, too, takes place, through which the whole or nearly the total amount of the ingested iron is removed. But it has not been found whether the iron does not act in some other way besides increasing the amount of the metal contained in the hemoglobin.

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After iron has reached the stomach it is decomposed into an oxide, and is absorbed, probably in the form of an albuminate. There can be no doubt, according to Dietl and Heidler, that it is absorbed in the stomach, and very probably the upper part of the small intestine also. It reappears in the bile and the pancreatic juice. Not only is that the case after it has been introduced into the stomach, but it will also reappear in the bile secretions of the intestine and pancreatic juice, according to A. Mayer, after it has been injected into the veins. It is true that Quincke was sometimes unable to find iron in the intestinal secretions after it had been injected into the blood, but it seems to be well established, according to the experiments of Prokowsky, that the temperature of the blood is elevated, the pulse accelerated, and the blood pressure increased after the use of iron. For this reason it ought not to be given during the height, or even during the course of inflammatory fevers. A number of its preparations are certainly vascular excitants. But for this very reason, while it is contraindicated in inflammatory fevers, it certainly is indicated and required in most cases of septic fevers.

The preparations most beneficial in anæmia of children are, in my opinion, the following: the lactate, the tincture of the pomate, the iodide, the pyrophosphate, the subcarbonate, and the tincture of the chloride.

The lactate and the pomate are very digestible, and may be given whenever the indication for the use of some mild preparation of iron is established.

The syrup of the iodide has an advantage over the other preparations of iron, because by its use two indications may be met—that is, where the additional aid of an absorbent is desired. Therefore, it is the proper remedy in cases of slow convalescence after inflammations resulting in exudation, particularly in disease of the glands and the lungs. It has, moreover, one peculiarity which makes it much more desirable than many other preparations, and that is, it is easily decomposed in the stomach; the iodine is set free, and acts as an antifermentative in the many cases of disturbed gastric digestion, occurring even in nor-

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mal children, and almost certain to take place in children whose circulation has been disturbed or whose gastric secretions are certainly below their normal amount in consequence of a deficient supply of blood.

The subcarbonate of iron is a very mild preparation, easily digested, and properly combined with a number of drugs, such as bismuth or bicarbonate of soda, is of considerable value when, in slow convalescence or progressive anæmia, this gastric catarrh threatens to interfere with the improvement in the general condition. The doses may be larger than those of any of the other preparations. A child two years will easily bear from 25 to 50 centigrammes daily. This quantity, combined with twice or three times as much subcarbonate of bismuth, and, if necessary, three or four times that amount of bicarbonate of soda, is a very proper remedy to be used in the conditions alluded to.

The tincture of the chloride of iron, when neutral, is a preparation which is also easily digested. Doses of a gramme daily, or more, are very readily digested, and prove beneficial. This can be easily combined with the bitter tinctures, stomachics, etc. The tincture of the muriate of iron is the one, amongst the ferruginous preparations, with the exception of those partly composed of ether, the acetate, for instance, which must be regarded as a vascular irritant, and wherever the action of the heart is lowered and blood pressure is diminished, it is the preparation which will be found most beneficial.

In a number of cases, the choice among the several preparations of iron is an indifferent matter, at least, so it appears to be. Still it has seemed to me that, in those cases in which I have had to deal with anæmia attended by gastric catarrh and digestive incompetency in the upper portion of the small intestine, the pyrophosphate proved very satisfactory. I have employed the compound hypophosphates and phosphates a great deal, which combine iron, potassa, lime, and soda, and, although it is well known that the elimination of these metals and metalloids is almost as rapid as their ingestion, still it appears that the effect produced by such combinations is a

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very happy one in just such conditions as those of which we have just spoken.

All these preparations are of special value in chronic anæmia, which is by far the most common affection. Acute impoverishment of the blood, such as that caused by severe puerperal hemorrhage or hemorrhage from the bowels, is fortunately very rare in infancy and childhood. Therefore, the opportunity for transfusion of human blood is seldom offered, even to those who are most fond of that particular operation.

The doubtful results of transfusion upon a large scale have induced a modern writer to make a number of small transfusions by means of the hypodermic syringe. He would withdraw blood from the vein of a healthy person and introduce it directly and immediately into the veins of the sick child, and he states that he has done so with favorable results. It seems to me that the plan is rational enough, but the future must decide whether the results will be as favorable as they have been reported, and whether there will not be grave objections to what is described as a very trifling operation. If it be successful, it would certainly, under equal circumstances, have the preference over the slow process of gastric, or of rectal alimentation, no matter whether injections of defibrinated blood or other nutrients are used.

In cases of chronic anæmia I have frequently used arsenic; one or two minute doses daily, after meals and well diluted with water, and with benefit. Of one thing there is no doubt, and that is that arsenic does good in a peculiar torpid condition of the stomach which will not digest and assimilate in consequence of the absence of both nerve power and gastric juice. Both in adults and in children, I have given it for the purpose of improving general nutrition, and I have not seen in children what very frequently occurs in adults when arsenic is given for nervous disorders, namely, gastric derangement. With iron, with or without stomachics, I have seen the appetite improving, the mucous membrane filling with blood, and vigor returning under its restorative influence. Doses: from two to five drops daily, of Fowler's solution.

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In this connection, I will state that strychnia, in my hands, has proved very beneficial as an adjuvant to either arsenic or iron. To a child two years old a dose of $\frac{1}{40}$ of a grain may be safely given daily, and this dose may be continued for a long time. Its action is well known in cases in which the digestion and the entire nervous power of the patient are simply lowered, and a few weeks' administration, together with proper food and either iron or arsenic, has changed the condition of the anæmic child considerably.

Phosphorus, in about the same doses as strychnia, has also produced very happy effects. They may be brought about by the influence of phosphorus upon the nervous system, or they may be explained by the effect which the remedy produces when given in diseases of the bones. Some ten years ago, Georg Wegner found that the fractured bones of rabbits fed upon minute doses of phosphorus, would unite much more rapidly than the fractured bones of those animals which were left to themselves. Since that time I have been in the habit of giving phosphorus in cases of acute and chronic disease of the bones of an inflammatory character, and in caries particularly, and my impression is that the large majority of cases do very much better when small doses of phosphorus, say $\frac{1}{50}$ to $\frac{1}{100}$ of a grain daily, are given, than when the disease is left to pursue its course without the use of this remedy. It is true that the time required by such a process as caries is long under any circumstances, but it has seemed to me that even caries of the ankle joint and the metatarsus was apt to progress very favorably in the course of a number of months when phosphorus was used, whereas years were required in other cases which had not received the same treatment.

I do not know that it has been used extensively in rhachitis, but it is not improbable that the good effect which phosphorus produces in anæmia, mostly of rhachitic children, is partly due to the fact that the bones especially show an increased tendency to normal development.

In many cases cod-liver oil is very serviceable; I need

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not speak of its effect, and shall only say that frequently the contraindications to its use are overlooked. Most children do not bear it well in the summer, when it is apt to produce either gastric catarrh or diarrhœa. Some do not bear it at all at any season of the year. It is with cod-liver oil as with any other remedy, particularly iron, of which I have already spoken. There are children who do not bear either, and, therefore, they must be treated without these remedies. At all events, it should not be forgotten, whenever digestion is impaired, whenever there is gastric catarrh, that these cases require preliminary treatment before the administration of either cod-liver oil or iron is resorted to.

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Prophylaxis.—Is there anything like a preventive of influenza? There is, contrary to Berger (*Die Infectious-Krankheiten*, 1896), and others, no infectious disease of equal communicability, either direct or indirect. Under extraordinary circumstances only is there a possibility of avoiding contact. Influenza may be prevented from entering a ship coming from distant ports, or a ship carrying it may be quarantined with rather more theoretical than practical effect. Influenza may be kept out of a monastery or a prison or out of an insane asylum or barracks if there is no intercourse with the rest of the world. It should be kept out of a sanitarium for lung diseases by strict isolation during an epidemic. Indeed, I know of no infectious disease that creates a greater disposition to tuberculosis than influenza. To close a school is unavailing, for the children will contract the disease outside. Expecto-rated mucus and the result of sneezing should, if possible, be caught and disinfected or destroyed; tools, toys, towels, handkerchiefs, and linen should be treated, *i. e.*, washed and disinfected as in other contagious maladies. To protect the children of a household the patient should be isolated on the upper floor of the house, a demand with which it is impossible to comply in the larger part of our population. Nurslings, if their mothers be sick, should meet them for nursing only. Sick and well children should use disinfectant mouth-washes. I think water slightly acidulated with hydrochloric acid will do best. Drinking-water should also be acidulated in the same manner and may have the same favorable result that is obtained in Asiatic cholera. The irrigation of the nose should be a matter of course in the well and in the sick, for the same reasons that have been urged by myself and very persistently and forcibly by Dr. C. A. Caillé against

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and during diphtheria. In this way mucus, which according to Ruhemann catches bacilli as in a net, is removed and the mucous membrane is kept in a healthy condition. In which way the bacillus enters is not entirely clear; if it invades through the mucous membrane like the pathogenous bacilli of tuberculosis or diphtheria or cholera, the more normal the condition of the mucous membrane, the greater is the protection.

Medicinal preventives have been recommended—cod-liver oil by Ollivier; calcium sulphide by Greene; quinine by many. Trials with it made on regiments of soldiers under control in their barracks were equally positive or negative. My experience with preventives is very small. Quinine appeared to cause headache and nausea.

Treatment.—There is no specific for influenza like quinine for malaria or salicylic acid for rheumatism. Innocent muriate of ammonium, also carbonate of potassium, sulphocarbolate of sodium, carbolic acid, ichthyol, and other remedies have been so recommended without the expected success. Thus, rational, hygienic and symptomatic and sustaining medicinal treatment only can be considered. A purgative dose of calomel should be given in order to clear the bowels of microbic and toxic ingesta, the bowels appearing to be the principal point of attack in young children. The patient should be kept in bed, the temperature of the room at 70° F. or more at first, the diet should be scanty and fluid at first—milk, cereals, farinacea, water, lemonades, and broths. The further development of the case will gradually indicate eggs, and perhaps—in a few selected instances only—alcohol in addition to other medicinal stimulants. It is more, however, a slow convalescence that requires it than the course of the disease itself. In this respect it appears to differ somewhat from other infectious diseases, particularly typhoid fever and diphtheria. In the latter the doses of alcohol should be high from the beginning.

If there be a high temperature, cold water is not indicated either as a bath or as a pack. The irritating cough which often requires opiates is rather increased than soothed by it; the characteristic bronchitis of influenza does

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not bear it; the frequent copious perspiration contraindicates it, and so does a weak heart under all circumstances. On the contrary, when there is much muscular pain and restlessness, a warm bath is often beneficial. Hot baths should be avoided unless a very short one in an occasional collapse, and Turkish baths require stronger heart-muscles than we are apt to meet in pronounced cases of influenza. While many common cases of pneumonia, with fair circulation, are apt to do well with cold packs, influenza pneumonias do better with warm ones.

According to Ditmar Finkler of Bonn quinine occupies a front rank.¹ Out of eighty of his patients treated with quinine only three made their appearance at the dispensary a second time, while of those treated with other drugs nearly one-half reappeared twice or more frequently. The favorable action of this drug has been observed by Dujardin-Beaumetz, Tessier, Carrière, Pribram and others. Mossé, to abort the disease, administered 1.0-1.25 grams the first day, sometimes also the second. Filatow has also observed its favorable effect especially in children. Others, however, as Eichhorst, Tranjen and Bowie, had no success in the use of this remedy, and Leichtenstern believed that the cases treated with large doses of quinine did worse than those that were not so treated. In the German collective investigation reports some praised quinine as giving brilliant results, while others were greatly disappointed in its effects.

Whenever vomiting is severe, stomach feeding is out of the question. The temporary abstinence and afterward rectal alimentation find their indication. Alcohol greatly diluted, peptones, mild salt solutions, and liquid albumins are readily absorbed in the colon which even in the smallest infant, though the fetal length of the sigmoid flexure may be persistent, is made accessible by elevating the hip and moderating the current by not raising the irrigator more than a foot above the anus. Peptonized milk, egg and broths are absorbed in part. Starch in the injection is dextrinized in the colon and thus adds to the nourishment

¹ Finkler. "Twentieth Century Practice of Medicine," Vol. XV.

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of the enema, but though water alone were injected it would add to the circulating fluid. That is why even a large enema given for the purpose of clearing the bowels may add to nutrition and strength by such of the injected water as is almost invariably retained. Thus, severe vomiting should be treated with refusing to feed through the stomach. The best relief is given by morphine, rarely by ice, either internally or externally. It is not necessary to send morphine down to the stomach; absorption is easy and more readily accomplished in the mouth or throat. A tablet of one milligram may be thrown into the mouth of a child of two or four years, there to be absorbed, or half a drop or one drop of Magendie's solution may be administered in the same manner without dilution.

The indications for the treatment of influenza may be several, the high temperature in many cases, the great discomfort, the restlessness, and the rapidly increasing exhaustion. In the treatment of many fevers it is their causes that require consideration;² in others, however, their relations to, and influence on, the body are the main considerations. When the condition of the latter is fair, and no danger is incurred on account of the fever, it should be left alone; when the rise of temperature, however, by itself is injurious, it should be interfered with. At all events the treatment of the symptom "fever" gives us no hope of shortening the disease in which it occurs or of which it forms a part; on the other hand, it is a satisfaction to know that, while we increase the comfort and diminish the immediate dangers, the natural healing process is not disturbed. In this way both the justification and the limitation of the so-called expectant treatment become evident. To allow a high temperature to deteriorate tissues and exhaust the heart or brain, is as injudicious as is the custom of emphasizing the number of degrees of Fahrenheit as the only valuable part of a morbid process. To be satisfied with depressing temperature is a grave mistake, but to allow pneumonia to run its deleterious course of high tem-

² Jacobi, A. Fevers and Fever Remedies, Albany Medical Annals, May, 1900.

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peratures unchecked with their full influence on the rapidity of respiration and the action of the heart and on the increase of waste, is equally injudicious.

In their injurious influence on nutrition protracted infectious fevers act, first, like direct losses or like starvation, and, secondly, as immediate poisons. The younger the patient, the greater is the danger from that source. That is why a high temperature without any or with a trifling remission should not be allowed to last, though its immediate effect may not appear very ominous. When a high temperature results in a convulsion we never hesitate to reduce it; here we admit there is a vital indication. Why, then, not reduce it while there is the danger of a possibility or probability of its occurrence? Add to these facts the disposition of the young to inanition which is caused by two main factors. The first is their rapid metabolism, the second and principal one is the relative, almost universal, insufficiency of the young organism.

Moreover, we should not forget that most of our antipyretics are at the same time nervines, analgesics and diaphoretics, thus improving comfort and metabolism. They are surely indicated when bathing is not sufficiently efficient or when baths are contraindicated; in that case they may act as adjuvants, as combinations, and procure sleep and remissions. If I add that there are, however, contraindications to the use of medicinal antipyretics because of possible idiosyncrasies and of the debilitating effects which many of the antipyretic drugs are apt to exhibit, I merely say what all have experienced, and what everybody should remember, *viz.*, that no degree of Fahrenheit and no Greek name of a morbid process are the subjects of our medication, but an individual patient. From these points of view our fever remedies should be judged.

In my paper of 1890^{*} I said that acetanilid ought to be preferred among the poor because of its low price, antipyrin mainly where great solubility was required for the purpose of its administration in rectal and subcutaneous injections, and that phenacetin was preferable to either

^{*} Jacobi, New York Medical Record, 1890.

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when it could be given by the mouth, because of its less uncomfortable effect on the brain, the heart, and the skin.

This opinion I have to modify to a certain extent, not that I object to what I said of phenacetin, but acetanilid should never have an opportunity to show what good qualities it may have, in the rich or poor. It should not be used at all, under any circumstances, not even in the quack preparations which now and then I know to disfigure the prescriptions of regular practitioners. Being a derivative of anilin, acetanilid is poisonous. Not only has it a sedative or rather paralyzing effect on the central nervous system, but it destroys the blood and causes anemia by changing hematin into methemoglobin, though given sometimes in small doses. That is what gives rise to cyanosis so often observed, more often than after the administration of any other of our modern analgesics and antifebriles. The poisonous effect is even noticed when the drug is used externally, mainly on the young. Examples of such cases were reported at the meeting of the Philadelphia Pediatric Society, April 11, 1899.

Antipyrin, when employed during normal conditions, increases the tension of the pulse and blood pressure—therefore it is contraindicated in hemoptysis—and produces perspiration. It works more on the general central nervous system than on the center of circulation, that is why it acts—while being antipyretic—as a sedative and analgesic. But it should not be considered as a nervine, for its action appears to be *ushered in* through the mediation of the blood and blood-vessels. The body temperature begins to decrease within fifteen or twenty minutes after the first dose; to render its antipyretic effect more tangible and persistent, it should be followed by a second within two hours. This rule, however, does not hold good when the drug is given for its sedative or analgesic or for its slight anti-rheumatic effect. Its general effect is mostly good, but its undesirable effects are many. Otto Seifert⁴ quotes eighty authors of note who report disagreeable effects of antipyrin; they

⁴ Seifert, Otto. Würzburger Abhandlungen aus dem Gesamtgebiet der prakt. Med., 1900.

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were observed in the gastro-intestinal, nervous and circulatory system, in the skin and in the mucous membranes. Phenacetin is dismissed with ten. It resembles acetanilid, but is very much milder in its effect. The transformation into methemoglobin takes place after large doses of several grams only. Half-gram doses for antipyretic, gram doses for analgesic purposes are recommended. The doses to be given to infants and children should be from fifteen milligrams to three centigrams (gr. $\frac{1}{4}$ - $\frac{1}{2}$).

Salipyrin, the salicylate of antipyrin, is employed by Finkler. While antipyrin causes perspiration, sometimes excessively so, he reports a case in which hyperidrosis was instantly cured by salipyrin. It should be given in twice the doses of antipyrin, is usually better tolerated than the latter, particularly by neurotic or neuralgic patients, because of the relative absence of accidental effects.

Salophen is extolled by Drewes of Hamburg, who prefers it to salicylic acid and to salicylate of sodium, mainly in the nervous form of influenza. Adults took from one to six grams, children from three to five decigrams. Finkler, who quotes him, adds: "I believe that most physicians have arrived at the point where they would not like to be without these preparations in influenza, but it should certainly not be forgotten that reports of this kind have quite frequently been used for advertising purposes."

There is something else that should not be forgotten, *viz.*, that there is hardly a disease which has as great a tendency to cause exhaustion and numerous other nervous symptoms, from languor to heart failure, as influenza. If there be the slightest indication of such a danger, none of the above-mentioned drugs should be given without the addition of a stimulant. That should, according to what I said before, rarely be alcoholic. Caffein preparations are vastly preferable; mainly the salicylate (or benzoate) of sodio-caffein, which being very soluble and readily absorbed, is almost ideal in its effect. That is why in emergency cases of heart failure its subcutaneous administration may often become indispensable. The use of strychnine is so well understood and so general that I limit myself to merely mentioning it.

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To what extent stimulants should be given in the average or in the grave cases depends on the general condition of the patient, and on his medical adviser's knowledge of his former health and his resisting power. It is probable that in most cases some daily doses of sulphate of spartein, five centigrams (gr. $\frac{5}{6}$) for a child of two years, will have a favorable effect. The caffein preparation I mentioned may be given in doses of from two to six decigrams (grs. ii-j-x) daily. When it appears to act as an excitant on the brain, it should be replaced by camphor in daily doses of from one to four decigrams. All these doses, however, should be much increased when strong stimulation is required, and in an emergency subcutaneous injections of the same drugs should be used, caffein being soluble in two parts of water and camphor in four parts of sweet almond oil.

One of the best stimulants, useful in the gravest of all cases which are attended with collapse and heart failure, is sadly overlooked among us, *viz.*, Siberian musk. I know of nothing better in the most urgent of cases. A child of two years should take of the 10 per cent. tincture five to ten minims every half hour until half a dozen or a dozen doses have been taken. Musk, together with large, hot enemata, has led me over many a difficult pass, and I again offer this experience of mine, which now extends over fifty years, as a contribution to your aid in dire distress, always, however, reminding you of the fact that all these measures are not exclusive to influenza, but to all conditions of nerve exhaustion, no matter from what cause.

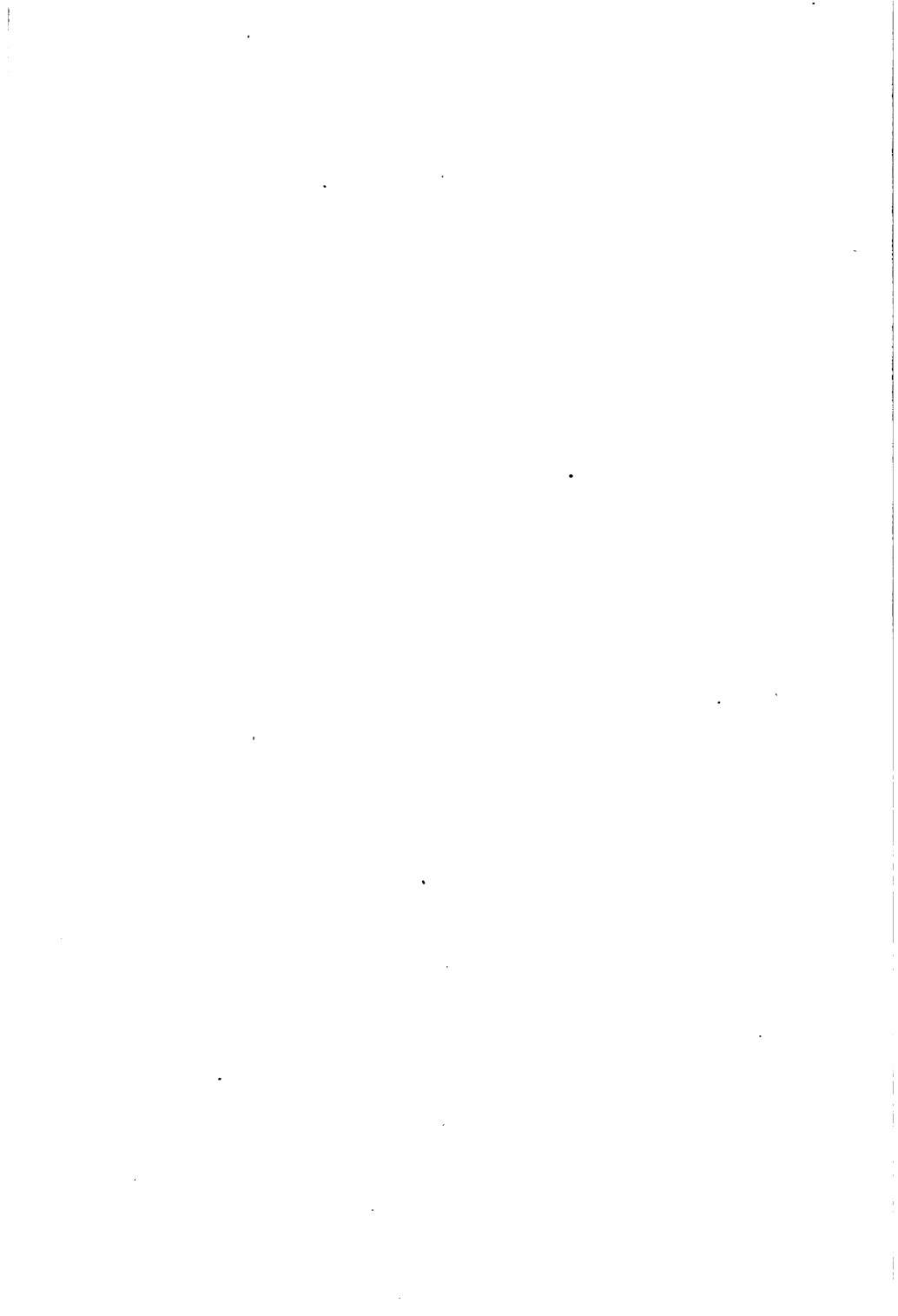
At last, let me allude to a singular experience which was published ten years ago. I do not know that it has been repeated since.⁵ Goldschmidt⁶ reports as follows: "About New Year's, 1890, a lady suffering from influenza landed in Madeira and disseminated the disease in a short time. Two months previously there had been an epidemic

⁵ In the discussion following the reading of this paper Dr. Holbrook Curtis referred to the internal use of vaccine virus by himself and others. A. J.

⁶ Goldschmidt. Immunity Through Vaccination, Berl. klin. Woch., 1890 and 1891.

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of smallpox and numerous vaccinations and revaccinations were performed. Now, it so happened that all those who were successfully vaccinated—112 all told—remained free of influenza. Of 98 who were vaccinated unsuccessfully, only 15 took sick.” The author concludes from this experience that successful vaccination is a preventive against influenza. But as yet there is not enough known to justify any such conclusion with anything like certainty. Still, it suggests the possibility of a future serotherapy for influenza and its very serious consequences.



OTITIS MEDIA IN CHILDREN

DR. G. HEERMANN published in 1898 a small book on "Otitis Media in Infancy (Otitis Comcomitans)." For a part of the critical history of that affection I refer you to him. When I looked over the shelves of our library which are filled with books and pamphlets written on the ear, and glanced over the literature contained in the subject catalogue of the Surgeon-General's Library, I was glad to remember that I must not take more than fifteen minutes of your time. This, then, is not an historical paper.

Otitis media is of frequent occurrence in the very young. It may combine with the retrograde involution of the embryonal myxomatous tissue, which may disappear soon after birth but persists often in the antrum and tympanic cavity and undergoes purulent softening. Otitis media may exhibit mild and grave symptoms, like every form of inflammation in other organs. For instance, the localized mild croupous or lobular pneumonia, and one that migrates or terminates in induration or in atelectasis or abscess, is still called a pneumonia and nothing else. Otitis may be either a mere surface affection of the mucous membrane, or one complicated or not with thrombosis, or suppuration, or caries, or facial paralysis, or meningeal or other complications, and is still denominated an otitis. It may be either primary or secondary to a naso-pharyngeal disease, or cause or be caused by, or appear contemporaneously with, pneumonia, meningitis, or enteritis;—it is still an otitis. That is why I decline to subdivide otitis as Heermann has done—into a bona-fide otitis and a concomitant otitis, the latter name being given to those forms which are observed in atrophic or emaciated infants, whose general illness, however, shows no actual differences in the symptoms or even in the course of their local disease, or in their bacteri-

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ology. What we have to remember is the fact that the same symptoms and extent of local changes do not belong to all cases equally, and that the same therapy is not adapted to every case.

Purulent otitis is frequently found in autopsies. Preysing found in those made on 100 infants that died of a variety of diseases, 81 affected with otitis media. Only 8 were unilateral, so that there were 154 diseased ears among 100 dead infants. Nor are older children exempt. Gelpert found a latent otitis media in 75% of all the inmates of the children's hospitals he examined. These are the same results which are obtained by previous and succeeding observers of the same disease when occurring at different ages. School-children have been examined in that direction a great many times, but I give only two instances which, so far as I know, have not been copied in our journals. Dillner found among 38 children that had to be excluded from their schools on account of incompetence 9 still suffering from inflammatory ear diseases; Kalischer, among 255 children excluded because they made no progress and hindered their class-mates, 80 with previous or still persistent middle-ear inflammations.

Pyogenous microbes enter the middle ear mainly from the naso-pharynx, which, according to R. O. Neumann,¹ contains even in its normal condition a large number of microbes, mainly *micrococcus pyogenes albus* in from 86 to 90% and the *bacillus pseudo-diphtheriæ* in 98% of all cases. In nasal catarrh there is a relative increase of the *bacillus pneumoniae* of Fraenkel and Friedlander, of *streptococcus pyogenes*, and of the *bacillus* of diphtheria. These latter may cause nasal catarrh, while the *bacillus pseudo-diphtheriæ* is a saprophyte only. Thus my frequent statement that many cases of nasal catarrh during an epidemic of diphtheria were diphtheritic—first based on clinical observations published in the *American Medical Times*, of August, 1860,—is confirmed by the most recent bacteriologic research.²

¹ "Zeitschr. f. Hyg. und Inf. Krkh.," 1902, vol. 40.

² "Therapeutics of Infancy and Childhood," 3d edition, p. 407.

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Microbes get into the middle ear in the contiguity of the surface of the mucous membrane progressively, not necessarily in every case of diphtheria, scarlatina, or other eruptive disease, but still frequently; or they are thrown in during coughing, vomiting, or sneezing. That is mainly so when the nares are obstructed by catarrhal swelling, or by the presence of mucus or of a membrane, or by a high degree of congenital deviation. Nurslings are in danger during suckling and deglutition—the more so the lower their vitality and the more fragile their epithelia, the feebler their circulation and the greater their emaciation. It is in these conditions that microbes, mainly cocci, which are ubiquitous in the accessible cavities, will enter the tube with great facility and meet those which are previously inhabiting it, and which become very effective by the circumstance that under the influence of ill nutrition, atrophy, and colds, the vibrating epithelia become paralyzed. This latter condition is easily produced, on account of the normally slow air current in the Eustachian tubes and in the middle ear. A very direct cause of otitis media is found in the presence of naso-pharyngeal diphtheria or straightforward “nasal” diphtheria, which in its mild or grave form is by no means so uncommon as a very modern author seems to believe, who thinks it worth while to publish, in three long articles, three new cases of primary nasal diphtheria. It is true that in this paper there is a display of such erudition as is apt to be exhibited in quotations. The author’s literature goes back to antiquity, and that antiquity to 1900, aye to 1890. I admit that is uncommon research in our over-productive journal literature. But there is still more ancient literature on the subject.³ In nasal and naso-pharyngeal diphtheria, otitis media is quite frequent, perhaps, however, not quite so frequent as we might expect if

³ The contributions to diphtheria, published in the *Journal of Obstetrics*, February, 1875; the article on “Diphtheria,” in the second volume of Gerhard’s *Handbook*, 1877; and the *Treaties on Diphtheria*, published by Wm. Wood & Co., 1880; even the several editions of the *Therapeutics of Infancy and Childhood*—all of which references are in our own library—contain what would have facilitated modern rediscoveries.

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we overlooked the cases in which the membrane is solid and firmly closes the orifice of the Eustachian tube. It is mostly observed in those cases of nasal diphtheria in which the membranous deposits are very light and flocculent and the secretions copious and acrid. It is principally this class of cases in which the nasal injections or irrigations introduced by me more than forty years ago prove life-saving, and, as to ears, preventive.

In diphtheria of the throat, a slight swelling of the mucous membrane or, as I have said, a moderate diphtheritic deposit may close the Eustachian tubes, and hard-hearing may be the result. In this class of cases the patient complains not infrequently of intense pain behind the angle of the jaw and in the ear, and in some cases the diphtheritic membrane is continued into the tubes, and gives rise to otitis interna and media, which finally terminates in perforation of the drum membrane, and occasionally in caries of the bones. Wreder⁴ collected 18 cases of diphtheria of the middle ear in scarlatina, complicated with the same affection of the fauces and nares. One child with diphtheria of the mouth and pharynx had also diphtheria of the inner ear. Kuepper saw diphtheria of the middle ear and Eustachian tube, and Wendt once in the tubes, and, amongst 84 cases of variola, twice in the middle ear, together with the same affection in the naso-pharyngeal cavity.⁵

A frequent cause of otitis media is scarlet-fever, with its coccic or bacillary throat affection. In mild or severe cases there may be perforation of the drum membrane, necrosis of the drum membrane and of bones, progress of that process to the antrum and the cells of the mastoid processes and to the sinuses and meninges, with the results of pyæmia, brain abscess, or septicæmia. In some of these cases of scarlatinal otitis media there may be, without many apparent local symptoms, fever, delirium, diarrhœa, or bronchitis. Many such cases while yielding no pain from pressure on the mastoid process exhibit fever, not

⁴ *Monatschr. f. Ohrenh.*, x., 1868.

⁵ Quoted from my *Treatise on Diphtheria*, 1880.

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always with a steep pyæmic curve, and merely a swelled lymph node on the mastoid process. In that condition it is safer to take these seemingly mild cases seriously, and to operate. Pus may be, and frequently is, inside the bone.

In measles, influenza, typhoid fever, and variola otitis media is not quite so frequent as in scarlatina. Otherwise, all the varieties of nasal, pharyngeal, and naso-pharyngeal catarrh, also adenoid vegetations and hypertrophied tonsils, are known to be frequent causes or accompaniments of ear disease. The influence of hypertrophied tonsils is perhaps exaggerated in the estimation of many of us in this, that when *uncomplicated* they do not easily cause otitis; but it is true that there are but a few cases in which they stand alone, by themselves. They are almost always complicated with catarrh in the neighborhood, and with accumulations of mucus which cannot be readily dislodged and undergo disintegration. To that fact Yeardsley drew attention seventy years ago. Altogether, to my certain conviction, the rôle of the tonsils in other conditions is also over-estimated. I may be permitted to mention here, as I have done many times before, that their influence in admitting cocci, bacilli, and toxins as a cause of scarlatina, diphtheria, tuberculosis, and rheumatism is inferior to the absorbing power of the numerous surrounding lymph bodies, for these latter are in a much more intimate connection with the lymph circulation than the tonsils which are surrounded by a firm capsule. Some of the causes which carry noxious material into the tube I have mentioned. I emphasize again the influence of coughing—mainly in whooping-cough, but also in pneumonia—of vomiting, and of sneezing, also possibly of medicinal and other injections into the nares; of a transfer by the fingers of enteritic material, particularly when the Eustachian tube is made more accessible by a bifid uvula, or when the soft or hard palate is fissured, or in the presence of impeding adenoids; for then the levatores palati muscles have no support and the muscles of the tubes are insufficient and atrophied.

Primary tuberculosis of the middle ear is rare. It may be the result of bacilli entering from outside through the perforated drum membrane, or through the Eustachian

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tube during coughing or sneezing. Secondly, it depends on invasion through the Eustachian tube in cases of pharyngeal, laryngeal, or pulmonary tuberculosis, or through the circulation. This happens mostly during the glandular and bone tuberculosis of the young, and in miliary tuberculosis. Altogether the reports differ in regard to the frequency of tuberculosis otitis media. Bezold found only 127 cases amongst 17,087 ear patients. Amongst the chronic abscesses of the middle ear 4.4% are tuberculous. Few of them occur in infants and children, that is only 5.5% of the whole number, while the remaining 94.5% belong to advanced age (Habermann). Abscesses of the internal ear though they be in tuberculous children need not result from or contain tubercle bacilli, though according to one statistical report 9% of all the abscesses were said to have been found in tuberculous children, and a few of them had miliary tuberculosis. The otitis media depended in almost every case on pneumococci.

In cerebro-spinal meningitis the ear is often affected, more, it appears, in some epidemics like that of this year (1894) than in others. I never saw a case of deafness and consecutive deafmutism originating in cerebro-spinal meningitis that recovered. Whether preventive measures may reduce this untoward experience remains to be seen. For nasal affections are frequent. In almost every case of mine, observed this year, there was catarrh; in all that were examined for it, diplococci meningococci were found in large numbers. This nasal affection may and does lead to otitis media. The labyrinth deafness occurring during the height of the disease has thus far proved very unfavorable.

Inflammations of the inner ear are rare, only two in Preysing's 197 cases. Perhaps the majority depend on cerebro-spinal meningitis. In one of these cases the transmission was not even direct, for the first result of the otitis media was a purulent meningitis, in the course of which the inner ear of the opposite side became diseased. Ménière's symptoms, namely, disturbance of the equilibrium, nausea, and vomiting, are not often observed. They will always get worse after quinine or salicylic acid.

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The contents of the middle ear may be visible through the drum membrane or not; the latter may bulge or not. That is why in very many cases otitis media may not be accessible to a diagnosis, and perforation of the drum membrane is not so common as might be expected. It happened in only nine of Preysing's 154 diseased ears. This infrequency of perforations is believed to be due to several reasons.

1. The greater resistance of the drum membrane in the young, the external cutis layer being often thicker than in the adult, the median connective-tissue membrane very solid, and the inner mucous membrane with its pavement epithelium at least as normal as in advanced age.

2. In the young the Eustachian tube is short but wider, both at the isthmus and at the tympanic orifice, and the direction of the canal almost horizontal. In the foetus the opening of the tube is below the level of the hard palate; at birth it reaches that level; in a child four years old it is about 3mm above it.⁶ That is why Preysing denies the easy exit of the pus into the pharynx. He claims, what is true, that the pus is mostly thick, and that pus would rather, while the baby is on its back, run into the mastoid antrum than through the tube. But the recumbent position is not always kept up, so long as the baby is not yet on the autopsy table. Bedside and nursery observers will appreciate this, and pathologists might.

It should be remembered that most of the figures quoted are taken from poorly developed, emaciated, even atrophic hospital cases. Now, atrophy affects the mucous membrane of the Eustachian tube as well as the rest of the body and adds to the width of the tube, which is thus wider in this class of patients than in the healthy and well-nourished. In this latter, perforation of the drum membrane is not so very rare, though indeed many a case of otitis media in this very class of patients, after fever, sensitiveness on pressure, and meningeal symptoms have been distinctly noticed, will run a mild course without perforation. Whatever pus does not find its way into the pharynx—no perforation having

⁶ T. Mark Hovell, 2d edition, 1901.

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occurred—is, or may be, absorbed, while the inner mucous membrane, including that which covers the drum membrane, will become thickened and give rise to hard-hearing or even deafmutism. Still there is another possibility, and indeed one of frequent occurrence. The copious net of lymph vessels in the young is always very active, in the emaciate and atrophic very greedy, and the absence (caused by the disease) of the pavement epithelium of the drum membrane and of the cylindrical and vibrating of the interior permits more rapid absorption. This condition is a sufficient explanation of the readiness with which absorption may take place from the interior of the ear into the lymph and blood circulation, and lead to deposits in distant organs, to mild or serious sepsis, to persistent exhibitions of temperature with no tangible cause, to death, or to slow recovery. Moreover, Preysing found on the inflamed surface, as the result of copious leucocyte migration, granulation globules with minute blood-vessels, without epithelia, resembling in shape small tubercles, and surrounded by slight hemorrhages and a narrow ring of beginning organization. These little granulomata, with their small blood-vessels, may also favor absorption.

The pneumococcus which is found in otitis is rather ubiquitous. As we find it in pneumonia, meningitis, pericarditis, peritonitis, and so on, we need not be surprised at meeting it in connection with the otitis of the young, with a pneumoemia, or with an enteritis, and their result. Pædatrophy and otitis have been known to combine, more than half a century. I was taught their clinical contemporaneity when a younger student of medicine than I am to-day, fifty-five years ago. Which of these complications,—otitis, pneumonia, enteritis, or meningitis,—is the primary one is difficult to say in most cases. To my mind, none of them is, in many a case, the primary cause of the general infection. Pneumococcus, being present on every healthy mucous membrane, will enter the circulation from any point, particularly from the nose, on which, by accident or disease, the epithelial cover is removed or on which it is disintegrated. Thus a meningitis may be the first symptom of a general pneumococcus invasion. It may be followed by

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other localizations or by general sepsis. Persistent diarrhœa, often fatal, is frequently observed in such cases. Homen and Laitinen, quoted by Preysing from *Ziegler's Beitr.*, vol. xxv., caused hemorrhages on serous membranes and diarrhœas, by injecting only the toxins of streptococci.

Meningitis connected with otitis media need not be purulent. Dr. Francis Huber published a case of otitic serous meningitis which recovered permanently.⁷ The patient was a child of two and a half years, suffering from adenoids and chronic aural discharge. There were general convulsions which returned frequently during the ten days preceding admission. There was semi-consciousness, the pupils were dilated, mainly the right; there was convergent strabismus and lateral nystagmus, rapid pulse, and taches. The tendon jerks were exaggerated. On the thirteenth day the mastoid process was opened, diseased bone removed, and the dura reached but not opened. Lumbar puncture was then made twice in two days, 30ccm and 16 ccm of liquor were removed. It contained no bacteria. Twenty-two days afterward the child was discharged and remained well.

In the atrophic infants the bone, with the exception of some parietal swelling, was not found to be affected. Even in healthy children the bony wall of the antrum is very thin, and small abscesses are apt to perforate before giving rise to serious injury.

PREVENTION

Nasal, post-nasal, and pharyngeal catarrh should be treated before they can do harm; adenoids removed, enlarged tonsils resected, and hypertrophy of the mucous membrane of the nose attended to. No operation about these parts is successful unless subsequent cleanliness be enforced. I have found that some operators neglect to avoid recurrences by not attending to that rule. One or two daily warm saline irrigations made *from a nasal cup*, during which the mouth should be kept slightly open—

⁷ *Am. Med.*, 1903.

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not injections—suffice for that purpose. Adenoids when small will get well without operation when these irrigations are gently and regularly made. Sprays or the use of droppers cannot take the place of irrigations. A spray of a .5 per cent. solution of silver nitrate through the nares once a week will work well. This application should be made several weeks in succession.

TREATMENT

A child with an acute otitis media should be in bed, the head and trunk raised. The raising of the head alone may lead to annoyance of the circulation of the neck. No feather pillows under the head. Symptoms will be ameliorated by a mild antipyretic, a narcotic, a purgative. Politzer and Valsalva are not adapted to the acute stage. Severe pain may be relieved by a few drops of cocaine solution instilled into the ear, occasionally by a leech on the mastoid process. Warm fomentations with spongiopiline, or simple warm wet cloths without or with antiseptic solutions should be tried. When pus forms the posterior half of the membrane bulges first; at its edge the hammer is distinguished. When an incision is required it should be made posteriorly and inferiorly. The expulsion of the pus through the incised wound can be facilitated by Politzeration, but this procedure may drive pus into the cells. Injections into the external canal should—if at all, be made toward the wall of the canal. Their advisability is favored and denied in equally strong terms. I do not use them. More than a dozen years ago I learned from my specialist friends the use of boric acid. After the ear has been wiped out with absorbent cotton it is filled loosely with boric acid. When this is softened with pus, the ear is again cleansed and the process repeated. This procedure has proved so successful that I remain true to the advice of my friends. I have often been told since that the method is bad and that injections into the external canal should be preferred, but I have read of deaths that have occurred after injections in the practice of such men as Troeltsch, Fraenkel, and Katz, and I cannot help appre-

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ciating the fact that enough people die without our aggressive co-operation.

To what extent sepsis depending on otitis media, pure or complicated, can be benefited, is uncertain. Anti-streptococcus serum is of very doubtful efficacy. Credé ointment may be used with a certain amount of confidence. It should be applied once or twice a day. The inunction should last half an hour, and absorption facilitated by the addition of a few drops of water to the ointment. Collargol acts more rapidly when dissolved in sterile water and injected into the rectum. Large quantities of water, drunk, injected into the rectum, or under the skin in the usual cautious way, are known to cause copious elimination from the blood, and deserve all the praise which has again been bestowed upon them by B. Alexander Randall in an article on "The Treatment of Otitic Septicæmia," which appeared in the *Journal of the American Medical Association* of November 26, 1904. Nuclein may be tried internally.

A. Bronner, of Bradford, England,⁸ publishes his opinion on the local treatment of some forms of non-suppurative catarrh of the middle ear by compressed air and a nebulizer, recommending for the purpose the compressed-air apparatuses used in America. He is careful enough to add what he takes to be a fact that many cases of so-called dry catarrh of the middle ear are not due to any affection of the mucous membrane at all, but to a primary disease of the osseous labyrinth. In these cases the use of the catheter can do a great deal of harm. If sudden great pressure be applied, the hearing and tinnitus may become worse. In dubious cases he uses the catheter with an iodine spray under very low pressure. It seems probable that in many of these cases we have after all to deal with the results of former inflammations that resulted in thickening of the mucous membrane. It is in these cases, though they be not syphilitic, that the internal use of an iodid or of "mixed treatment" may be expected to do good. But as a rule, and that I emphasize more than anything else, chronic

⁸ *British Med. Journal*, November 5, 1904.

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disease of the mucous membrane of the ear will never get permanently cured unless the chronic catarrh of the nasopharynx receive constant attention. After all, the treatment of non-suppurative disease of the middle ear is rather ineffective. Nothing is more corroborative of this old experience than the discussion lately held in the *British Medical Association* by eighteen gentlemen, well-known in their specialty and literature, a few of them our own fellow-countrymen.⁹ The latest paper on "The Present Status of the Treatment for Deafness Due to Chronic Catarrhal Otitis Media," published by Dr. Philip D. Kerrison in the *Journal of the American Medical Association*, November 12, 1904, expresses itself in the same strain.

⁹ *British Med. Journal*, November 5, 1904.

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NOTHING would have pleased me more than to appear before you, who have kindly consented to listen to me part of an evening, with something absolutely new. The history of medicine, however, exhibits but very few instances of striking novelty. It is more replete with the proofs of a slow and steady evolution than with sudden and unthought-of revelations. Still, there is one peculiar feature both in the study of our science and the practice of our art—viz., that wherever we approach it it is intensely interesting. That is why even the men borne down with hard work, and altogether too often near the brink of mental and physical exhaustion in the performance of their arduous daily duties, are always roused to enthusiasm by a single new experience, an unheard-of fact, a novel hypothesis, or only a new point of view calculated either to enlarge their horizon or to benefit their fellow men.

To me the connection of the kidneys with the rest of the organism has been a subject of interest through all my professional life. These organs are so intimately interwoven with the whole physiological existence that either their anatomy or their function participates in every disease of every organ. This is particularly perceptible in the infectious diseases, no matter whether mild or severe. In many of them one of the forms of nephritis is very common. In scarlatina, for instance, the desquamative process is quite active in the uriniferous tubes, and results in a peculiar form of inflammation; in some cases of scarlatina and most of the other acute eruptive and infectious maladies it is parenchymatous changes that are more frequently met with. Thus, indeed, it is worth while to study the urine in every case of disease. It is true that we are not always rewarded with the finding of severe lesions; for, happily, most of the cases of secondary nephritis are neither

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dangerous nor of long duration. But there is none of them but may lead to a severe form, with possibly a fatal termination. Therefore, the frequency of infectious diseases in infancy and childhood ought to fix our attention constantly in the direction of the kidneys. It is true that sometimes we are unable to find anything but albuminuria, which, in the absence of kidney elements under the microscope, we are liable to dismiss as transient and of little account. But in this we are very apt to be mistaken. My cases of uncomplicated and transient albuminuria have become wonderfully scarce since I invariably employ for the examination of the urine the centrifuge. Among twenty successive cases where the verdict is "trace of albumin" I am certain to find in the centrifuged deposits of nineteen, within a few minutes, the almost uniform result—blood-cells, hyaline casts, hyaline casts studded with epithelia, or finely or coarsely granulated casts.

Many of these forms of nephritis are, as I said, short-lived. Quite often will they disappear within a week or ten days. But this happy termination is far from being universal. There is nobody here but has been surprised in a child of advanced age or in an adolescent by an attack of uræmic convulsion, the cause of which could be traced to a scarlet fever which, six or ten years ago, terminated in apparent recovery. The same experience is had with nephritis from other causes; for, unfortunately, we know by this time that besides scarlatina, measles, varioloid, and varicella, even vaccinia, acute local diseases of the skin, erysipelas, rheumatism, typhoid fever, acute and chronic intestinal diseases may be complicated with or followed by nephritis. For this reason nephritis is very common in infancy and childhood, and ought to be searched for whenever the origin of prominent or dangerous symptoms is not at once clear. Fortunately, it is easy to obtain a specimen of urine, for catheterization is more readily successful in the child than in many adults. Thus it will frequently happen that a nephritis is found when the prominent cerebral symptoms suggested the diagnosis of encephalitis or meningitis. Of the many cases of this nature which I have met with, the following will furnish an illustration:

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A boy of five weeks who had appeared to be in fair health was taken with high fever and convulsions. The case occurred in a family living in very moderate circumstances, therefore, the medical man had good reason to suppose that the infant had been ailing some days before it was considered necessary to call him in. The temperature was 104° to 105° F., the pulse almost uncountable, and the convulsions had not been frequent when I saw the patient. There was some cyanosis and perspiration over the upper part of the body; the legs and feet were cold, the head was very hot. There was no œdema. The pupils were equal, fairly dilated, contracted a very little, but sluggishly, under the influence of a strong ray of light, and under the same light dilated again and contracted within certain limits. The equality of the pupils, combined with that peculiar floating condition of the iris, made me think of uræmia as the cause of all the cerebral symptoms. The urine was known to be scanty, but that is what it also is in meningitis, and in every child that has not been supplied with a sufficient quantity of water. Fortunately, there was some in the bladder. Boiling almost solidified it, and the microscope revealed blood-cells, epithelial and granular casts, the latter both fine and coarse. The child died; no autopsy could be had. No clew could be found to the causation of the fatal disease; and still, the baby was so young that in all probability the origin of the fatal nephritis might have been found in some occurrence of the first few days of life.

It is this period of early life to which I mean to direct your special attention to-night by reporting a few of the many cases of nephritis met with within a few days or weeks after birth. Some are primarily renal diseases, some are secondary. To the latter class belong those nephritides which are complicated with or dependent upon *intestinal disorders*. This connection is quite frequent. In many instances diarrhœal disorders are the *results* of nephritis, but quite frequently both acute and chronic intestinal diseases appear to be the *causes* of nephritis, which may be quite ominous; for indeed it is here as in other diseases,

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many of which are liable to terminate fatally by their renal complication. Every practitioner loses many a case of pneumonia, not through the severity of the pulmonary lesion, but on account of the accompanying nephritis. In this way the entero-colitis of the newborn is quite apt to destroy life through nephritis. In a highly creditable essay (*Arch. f. Kinderk.*, 1894, xvii, p. 222) Felsenthal and Bernhard have studied the connection of nephritis with acute and chronic intestinal disorders of infancy and childhood. They have also collected the literature on the subject. Parrot met with it in the atrophy ("athrepsia") of young infants; Kjellberg, Fischl, Stiller, Baginsky, Hirschsprung, Hagenbach, Henoeh, Epstein, and others have recorded cases of nephritis accompanying intestinal disorders. The cases of this description are by no means rare in the first week of life. When I look over the list of the numerous cases of the kind I have personally seen, it almost seems to me supererogation to record a case; and still I know that many of my colleagues with whom I saw the cases appeared to be surprised at recognizing both the presence of nephritis in such cases and the facility with which the diagnosis could be made.

The literature on the subject is but scanty. I have, however, reason to believe that even those who have known the connection between intestinal diseases and nephritis quite well have not published their experience. It has happened to me personally that my chapters on catarrh and ulceration of the bowels in my *Intestinal Diseases of Infancy and Childhood*, 1887, are silent on that subject by an oversight of my own. But in the discussion on Two Cases of Acute Primary Nephritis in Infancy, by L. Emmett Holt, one of which was perhaps caused by intestinal sepsis without that explanation being suspected, I took occasion to say (*Trans. of the Am. Pæd. Soc.*, 1891, vol. iii, p. 233): "There are cases of nephritis which complicate intestinal diseases. It is true that many spells of vomiting and diarrhœa are merely symptoms of nephritis. A number of cases supposed to be cholera, even Asiatic, are found to be acute nephritis. On the other hand, where we have to do with an acute or subacute intestinal catarrh,

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a prolonged seizure may give rise to secondary nephritis. I am positive that it will be found to be much more frequent than it was considered to be." In the *Archives of Pædiatrics*, June, 1890, p. 420, diarrhœa is also briefly mentioned by me as one of the many causes of nephritis.

It is but two years ago that a colleague presented a boy, five days old, the child of very poor parents, at my office. The cord had fallen off and the stump looked normal. The mouth was slightly covered with sprue. The lips, fingers, and toes were cyanotic, though the feeble heart appeared normal; the baby was nearly collapsed. Rectal temperature, 103° F. For two days there had been loose mucous discharges in great numbers; they were slightly offensive, did not contain meconium any more, but already at that early time coagulated masses of casein. There was no tenesmus and no blood. The urine of the second and third day appeared to the attendants darker than normal; during the last day but little had been passed. We drew about ten cubic centimetres of a dark, smoke-colored fluid. It contained albumin in great quantity, and under the microscope blood-cells, epithelial and granular casts, and urates. The baby died the following day. No autopsy.

It was a similar case that I saw with the same gentleman a few months afterward. He made the diagnosis before I met him. It proved one of the most fortunate I have seen; firstly, because it was not so severe as the former, and, secondly, because there was ample time to restore and equalize by warm bathing both the cutaneous and general circulation, to cleanse and disinfect the intestine and fill the blood-vessels, to establish a flow of urine through the uriniferous tubes by means of copious and frequent irrigations of the bowels, and to stimulate the heart by judicious doses of strychnine, of which the infant took nearly a milligramme during twenty-four hours.

What little I have said of the nature of the discharges, their offensiveness and frequency, suggests the cause of the secondary nephritis. It evidently depends on the absorption of a toxine, no matter whether it originates in the

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invasion of a streptococcus, or of the bacterium coli, or one of the other forms of microbes detailed by Booker and by Jeffries in the *Transactions of the American Pædiatric Society* of 1889.

Their absorption is facilitated by some peculiar anatomical conditions.

The muscular apparatus of the intestine of the fœtus and of the newborn is but slightly developed. During fetal life its function is but trifling, and its contents move but slowly. Immediately after birth that muscular debility predisposes to colic, as air which is swallowed; and gases, both innocuous and putrid, which are developed in the tract, are expelled with difficulty. Besides, the infantile digestive tract is unexpectedly long. According to Beneke, the proportion of the length of the body to that of the small intestine is in the adult 100 to 450; in the newborn, however, 100 to 570; in the second year, 100 to 660. Moreover, the villi are generally numerous and large; some assert they surpass in size those found in the adult intestine; the capillaries of the villi, it is claimed, have greater absolute size, so much so that their diameter is larger than that of the same vessels in the adult.¹ All this tends to show that both the accumulation of septic material in, and absorption from, the interior of the intestines is rendered very easy. The access of microbes to the intestinal tract of the newborn is by no means difficult. How they enter, through the mouth, the anus, or the blood, I have but recently discussed in the first number of *Pædiatrics*. After all, it seems that the nephritis originating from intestinal infection is of a similar nature to what we observe in typhoid fever or any of the other infectious diseases.

Nephritis in *typhoid fever* of the newborn I have seen but once, for the simple reason that I have observed but this one case of typhoid fever in one so young. It was cursorily mentioned on page 29 of my *Treatise on Diphtheria*, 1880. The baby died on the sixteenth day of its life,

¹ A. Jacobi. *Intest. Dis. of Infancy and Childhood*. George S. Davis, 1887. Chapter on Intestinal Digestion.

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twenty-two years ago. The mother recovered. Its kidneys were much congested, the two substances hardly discernible from each other, and blood oozed from the cut surfaces. There had been anuria for two days, and no urine was found in the bladder after death.

In one of the three cases of *diphtheria* in the newborn, reported on page 30 of my *Treatise*, I was favored with an autopsy. The baby was taken seven days after birth and died on the ninth. The kidneys were in the condition described in the previous case. No microscopical examination of the urine could be had.

In connection with this subject I now present the case of the youngest patient I have seen destroyed by *potassic chlorate*.

B. C., a boy of nine days, was seized, January 15, 1882, with convulsions, after not having voided urine for several hours. The last time, when a teaspoonful was passed, it was of a dark color, stained the napkin, and seemed to give pain during the discharge. There was constant rectal tenesmus, with some protrusion of the bowels, some five or six hours before the convulsion. During all this time the complexion was sallow, and the lips and finger and toe nails were blue. I saw the infant after the convulsions, with hardly a pulse, bluish lips, brownish complexion, the scleræ still yellow and largely ingested with dilated blood-vessels. Heart beats from 200 to 220 a minute, scarcely perceptible. Within an hour after my visit he died. The blood in the whole body was of an intensely dark color, the heart of normal size and structure, ductus Botalli nearly closed, ductus venosus Arantii still open. Lungs and spleen were engorged and purplish, so was the liver. The kidneys were large; a number of blood points—small hæmorrhages—were visible on the longitudinal section; there were, besides, a number of dark streaks corresponding with the uriniferous tubes, and the difference between the two renal substances was almost extinct. Their color was unusually dark, and they offered a strongly marked elastic resistance to the touch. What little urine (about two cubic centimetres) was taken from the bladder contained much pelvic epithelium, and consisted almost exclusively of decomposed blood-cells.

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The great resemblance of this form of nephritis to what I had described in the third volume of Gerhardt's *Handbuch der Kinderkrankheiten*, article Diphtheria, in 1877, and in a paper on The Remedial and Poisonous Effects of Chlorate of Potassium, published in the *Medical Record* of March 15, 1879, made me inquire rather scrupulously into the history of the dead baby. The mother had suffered from copious vaginal discharge during the last few months of her pregnancy. Neither she nor her surroundings were of the cleanest. The first few days of the infant's life were normal. On the third and fourth day sprue developed and covered lips and cheeks with thick deposits. The midwife in charge called no physician. She knew the best thing for sprue and inflicted it. She brushed the mouth with a saturated solution of potassic chlorate, as she proudly asserted, quite often, and frequently gave a few drops to drink. I could not learn the strength of her solution. She always used it and it had a powerful effect, she said. As far as I was permitted to learn, she dissolved a tablespoonful in a tumblerful of water; I still found a sediment of the salt in the bottom of a tumbler.

A case of nephritis after vaccination was reported by Perl in the *Berliner klinische Wochenschrift*, 1893, No. 28. It behaved exactly as nephritis in infectious fevers. The child, two years and nine months old, became very restless about the usual time of the onset of a vaccinia fever—viz., from the fourth to the fifth day; at the same time there seemed to be abdominal and lumbar pains. Within a day after, simultaneously with the appearance of six vaccination vesicles, there was albumin in the urine to the amount of one half of a per mille; also hæmatin, blood-cells, and some leucocytes. The casts were either purely hyaline, or hyaline studded with epithelium. The child was well on the twelfth day. The whole morbid process ran its full course in six days, with no serious symptoms at all.

The following is a case of a similar description in a very young infant:

In an immigrant hotel of Greenwich Street, New York, I saw with Dr. John Bishop, April 4, 1877, two children, one

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of four years and one of three weeks, who had been vaccinated ten days previously. I was expected to see the older one, who had an erysipelas of moderate size and severity; it got well after twice traveling over the surface of the body. On the very day of my visit the baby, who had run through her vaccinia fever with no unusual discomfort, was seized with an attack of convulsions. When I saw her there was a rectal temperature of 103° , a dazed look, injected conjunctivæ, pupils equal, somewhat dilated, and floating under the influence of light. The latter symptoms induced me to draw urine and examine it. It was scanty and contained a trace of albumin, a few blood-cells, and hyaline and finely granular casts. This nephritis lasted two weeks before it finally disappeared. During all this time there was no other convulsion, no œdema, but an occasional vomiting spell and diarrhœa during the first week of the illness; the pupil symptom persisted; the temperature varied between 101° and 103° , a moderate remission taking place in the morning. During the second (and last) week of the disease all the above symptoms gradually disappeared, and the temperature went down. In their place a slight œdema of the lower extremities and of the face was observed. The microscopical changes in the condition of the urine remained the same about ten days after they were first discovered. Then they disappeared, and recovery remained undisturbed.

Renal disorders, more or less dangerous, are direct results of *sudden changes in the circulation*, without or with visible alterations of the blood. To the first class belongs a case I once saw with a medical friend who had so much confidence in the vitality and vigor of the newborn that he commenced to enforce his theories on the necessity of early hardening immediately after birth. He would plunge the newcomers into cold water, and feel a grim delight in taking their incipient breath away and making them shriek in reflex self-defense. Two of his victims I saw with him; they died within a fortnight. The second we examined post mortem. There was a pneumonia, it is true, perhaps sufficient to destroy life. But the most apparent and probable cause of death, preceded by suppression of urine, was

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evidently bilateral nephritis. Both the kidneys were large, intensely congested, and blood poured out of the cuts; the difference between the two substances could not be distinguished. With him I saw no more such cases, for I suggested the probability that the cold bathing of the newborn furnished us the specimen. But the more I have seen of similar cases in the adult, the more do I feel that I was correct in my charge. For acute nephritis, interstitial, sometimes hæmorrhagic, is an occasionally unavoidable occurrence in sudden suppression of cutaneous circulation. Who has not seen death occurring from nephritis, not preceded by a chronic affection, in persons who have been resuscitated from drowning in an ice-cold river, or have been exposed to a driving rain storm while exerting themselves to get under shelter, or to cold and sleet in an open sleigh? What the slow influence of cold can not accomplish in the healthy and vigorous, what not even a nephrectomy can accomplish in the remaining kidney, its sudden effect on the feeble, or fatigued, or even the vigorous, will easily bring about. No matter whether the reasons are to be sought for in an antagonism of the skin and kidneys, or the enforced elimination of cutaneous excrements through the kidneys, the facts are actual. Moreover, direct experiments made by Lassar unmistakably prove the causation of interstitial inflammation by sudden refrigeration.

Like excessive *cold*, *heat* may lead to nephritis and death. Only once have I seen a newborn sacrificed in that way through his first bath. The midwife evidently had anæsthesia or analgesia. Bystanders noticed the steaming of the water in the bath tub, the suffering of the suffocating baby, his livid appearance; and the raising of large blisters on the surface told the story. The baby died within a day, having lost some blood mixed with meconium and passed no urine. Even the bladder was empty at the autopsy, and deeply congested. The kidneys were livid and succulent; blood oozed out of the cut surfaces. Blood was also extravasated under the capsules. If the case had run a longer course, in all probability hæmoglobinuria, produced by dissolution of blood-corpuscles, would have shown itself, as in the experimental researches of Ponfick

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and of Wertheim. Changes in the general circulation need not, however, be of this sudden and violent type, and still result in some injury.

Indeed, the albuminuria of the newborn is frequently due to the *insufficiency of circulation*, and passes off when the latter is freely established; just as the venous obstruction caused by heart or lung disease results in temporary albuminuria in the adult. In a certain number of these cases of almost congenital albuminuria there is no blood under the microscope, in others there is, in others there is more—viz., nephritis. It is probable that after most cases of protracted *asphyxia* of the newborn albumin will be found in the urine, with or without blood. Thus the kidneys repeat but the process which has been so much better studied in the brain by Langdon Down² and also by me.³

Indeed, in three cases of nephritis, two of which proved fatal, observed within five weeks after birth, no ætiology except that of previous long-continued asphyxia could be elicited. It was in those two that granular and coarse casts were in the majority; in the one which survived, there was still after weeks blood and a few epithelial and finely granular casts.

In *congenital heart diseases* with cyanosis, albuminuria is quite common. Again I warn against the facility of overlooking it. Time and again I am told there is no albumin in a specimen; time and again there is in such cases a trace, which is called "only a trace," but yields fields full of different casts in the centrifugal specimen. This very trace is sometimes not discovered unless the test tube be looked at through water, and unless some little time is given for the coagulation to become visible. Nephritis does not always work with heavy loads of albumin; that the last stage of chronic nephritis of any period of life may be without albuminuria for weeks in succession need not be retold.

I once saw a baby of four months, who had *spina bifida*

² *Transactions of the Obstetrical Society*, London, 1876.

³ *American Journal of Obstetrics*, xxiv, 1891, No. 6.

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and consecutive paralysis and contractures of both lower extremities, die with nephritis. We seldom see our patients with spina bifida when they breathe their last; for, until a brief time ago, most of them were left to die without an attempt at relieving them, and a neighboring medical man was called in at the last minute so that a certificate of death might be obtained. The same opportunity of observing a fatal case of nephritis in a little girl of three months I had about the same time. The patient had a *paralysis* of both lower extremities, dating from birth, and occasioned, probably, by an intraspinal hæmorrhage caused during difficult extraction in breech presentation. Maybe I am correct when in both cases I attribute the renal changes, chronic in character, to the fact that the circulation being impeded by the muscular inactivity of a large part of the body was more directed toward the internal organs. Maybe, however, this suggestion does not appear acceptable,⁴ for it is possible to assume that the same violence which caused a spinal hæmorrhage and paraplegia was sufficient to produce the same effect in the kidneys.

In the newborn we observe not only the adverse results of the sudden changes from foetal to post-natal circulation, but also lesions depending upon the *peculiar structure of the blood-vessels*. The newborn is removed from the embryo and foetus by a single station only. Its tissues are in part still embryonic, and endowed with less solid structure. This is why hæmorrhages are so very frequent in the newborn. Meningeal hæmorrhages are most frequent during the first week, and the slight coagulability of the blood of the newborn adds to its dangers. In regard to the brain, I have considered this question years ago, and frequently since, mostly in connection with asphyxia in the newborn. A large number of cases of idiocy, epilepsy, paralysis, and insanity in the very young are due to meningeal hæmorrhage of early days often ushered in by asphyxia. Similar occurrences take place in

⁴ As above stated, not even the removal of a whole kidney results in a nephritis of the other.

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other organs. Disseminated pleural and pericardial hæmorrhages are quite frequent in the newborn under the influence of retarded or interrupted circulation. When the latter improves, the hæmorrhagic points may become absorbed. So it is in the kidneys.

Parenchymatous hæmorrhages are capable of causing inflammation in the kidneys as they do in other organs. In many cases, however, they prove innocuous. In the muscles, the brain, the lungs, extravasations take place without leaving any trace behind. It is probable that whenever no healthy tissue is torn, when an extravasation takes place between fibrillæ, absorption takes place. When there is, however, an actual lesion of tissue, a secondary inflammation is or may be the consequence. Many years ago I was startled by an acute nephritis appearing in a delicate but healthy boy of four years, the son of a well-known practitioner in New York. None of the usual causes of the disease could be traced, and I was perfectly at sea until a crop of petechiæ appeared over the chest and the extremities. I then learned that six months previously the child had had another attack of purpura which gave rise to no symptoms, and that a few days before the first symptoms of this acute renal disorder there had been a few petechiæ all over the surface. The urine showed under the microscope rather an unusual amount of blood, together with plenty of blood casts and granular casts. It struck me, therefore, that the nephritis was in this case due to disseminated renal hæmorrhages, and I ventured to give a rather favorable prognosis. It took but a few weeks before the patient had fully recovered. Two similar cases have been encountered since, one in a girl of seven, one of eleven years. Both recovered. Never before did it occur to me to look upon the kidneys as more than very rare participants in a purpuric process, except in cases of actual hæmaturia.

In two newborn infants I have seen similar processes originating from the same source. A boy of five days was seen for *melæna* on his fifth day. There was vomiting of blood; there were bloody stools. Their color was not quite black; some of the blood was red, and its origin could

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be assigned to the lower part of the intestinal tract. The baby appeared to recover a little from the sudden shock of the loss of blood, when, on the next day, slight traces of blood appeared in the urine. Part of the blood cells were tolerably normal. Within another day the quantity of urine diminished greatly and assumed a smoky hue. The microscope still revealed blood cells, but also blood casts, a very few epithelial and many more finely granular casts. The baby died and the kidneys were removed. Both of them were markedly congested. On the walls of the pelvis were superficial hæmorrhages; sections revealed a number of rather fresh blood points. There was no doubt in the minds of all those present that the nephritis in this case was due to the irritation set up by the local hæmorrhages.

Another case dates twenty-six years back. After a protracted labor a boy was born in breech presentation. Ecchymoses over the abdomen proved the difficulty of parturition and the summary procedures of the midwife in charge. Almost the first urine voided by the infant was bloody, and the diagnosis of traumatic renal hæmorrhage appeared justified. Within a day the blood disappeared almost entirely, and urine became suppressed. The baby died on the fourth day, and was subjected to a coroner's inquest. There was a moderate amount of blood clot under the peritoneal covering of the liver, the liver was torn to a distance of about three centimetres, the peritonæum slightly torn, and blood had escaped into the abdominal cavity. Both kidneys were large, dark, and blood-stained on section; the two substances hardly differed from each other.

These were extreme cases, and their diagnosis was in a short time followed by death. How many there may occur in which extravasation is but moderate, and the amount of local or perhaps unilateral nephritis is not immediately fatal, perhaps even inclined to get well, is difficult to say. Large maternities, however, and foundling institutions are better prepared for observing such occurrences than the practitioner engaged in private or consulting work.

Frequent causes of nephritis of the newborn are *uric-acid infarctions*. They occur from the second to the

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twenty-third day, but also before birth.⁵ They are of different varieties. In a part or in all of the straight uriniferous tubes there are found yellowish-red or brownish, spherical or angular bodies in such quantities as to form considerable deposits and, when they are discharged during life, to cause large stains of more or less solidity in the napkins. They are in rare cases accompanied with blood. They consist of uric acid and of ammonium urate. The latter is readily soluble in acetic acid, from which uric acid crystallizes in rhombic shapes. In one case Ebstein met in the tubuli contorti with yellow globules consisting of uric acid and an organic stroma which contained no mucus, but consisted of albuminoids which were soluble in acetic acid, and exhibited either a concentric structure or irregular layers. At once the question rises in our minds as to the nature of this organic stroma. It must strike us that it can be of either of two origins. It is either depending on a cause not connected with the presence of the uric-acid infarction, or it is the direct consequence of a local irritation caused by the deposit—viz., secondary exudation. In this manner that form of infarction would, by itself alone, exhibit a mild degree of nephritis.

A second form of renal infarctions is of a *hæmorrhagic and pigmentous* nature. They look very much like those already described, and are found in the same localities. They are granular, spherical, or irregular conglomer-

⁵ Virchow's original opinion, according to which the presence of uric-acid infarction requires a certain duration of life, has been to a certain extent rescinded by the proof furnished by a premature and stillborn foetus which contained uric acid in its urine and urate of ammonium as sediment. Moreover, well-developed uric-acid infarctions were observed by Martin (*Jenaische Ann.*, 1850) in a foetus born in the unruptured membranes after an unsuccessful attempt at respiration. Hoogeweg (Casper, *Viertelj.*, 1855) met with them in an infant whose heart ceased to beat three quarters of an hour before delivery. Birch-Hirschfeld has a similar case, and Hofmann (*Gerichtl. Med.*, fifth ed., 1891, p. 748) published the cases of two infants, one of whom lived but twenty-three hours, the other only fifteen minutes, who exhibited uric-acid infarctions in full development.

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ates, which contain crystals of hæmotoidin. They are the results of small extravasations originating in general hyperæmia of the canaliculi, and depend on various causes, to the principal of which I shall return. The usual changes of hæmatin alter the color of these deposits, which contain no crystals of uric acid or ammonium urate, and are not affected by acetic acid.⁶

Calcareous deposits are also found in the newborn. They occur mainly in the lower end of the straight canaliculi, near the papillæ, are of a whitish color, and may, therefore, be mistaken on inspection for interstitial indurations. They are mostly either carbonate or phosphate of calcium, but rarely triple phosphate, and are soluble in dilute hydrochloric acid. They are, under favorable circumstances, deposited into and upon the epithelia.

Which are these favorable circumstances? Both phosphates and carbonates of calcium are known to be deposited from the blood whenever circulation is retarded or impeded; for instance, in the older baby in the latter stages of epiphyseal rhachitis. In the newborn the circulation is retarded or impeded by congenital (or rapidly acquired) heart disease, by general debility, or by asphyxia. As early as 1883 (*Virch. Arch.*) Litten counted among such favorable conditions a coagulation necrosis occasioned by the interruption of circulation. Thus these forms of retarded

⁶ Crystals of hæmatoidin (=bilirubin) were found by Virchow as early as 1847 (*Verhandl. d. Ges. f. Geburtsh. in Berlin*, vol. ii) in the kidneys, the tissues, and the blood of infants who died while suffering from icterus neonatorum. Their main location is in the renal epithelium and in the uriniferous tubes, but rarely in the urine. They are also found in the fibrinous coagula of the heat, in the parenchyma of the liver (Orth), and in the adipose tissue of the omentum (Neumann). Even in macerated fetuses they were met with by Neumann and Ruge. It appears, therefore, that at the time of birth, and soon after, bilirubin exists in the blood and tissues (with or without jaundice) in a sufficient quantity to permit its getting free in crystalline form even after death. The presence of genuine uric-acid infarctions is not influenced by this phenomenon, and they and bilirubin may occur simultaneously or separately.

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circulation, to which I alluded before in a different connection, exert a baneful influence from a chemical point of view.

The normal frequency of uric acid and other renal infarctions explains the great many cases of gravel and stone in the very young. They are observed in the earliest age, contrary to the opinion of Rosenstein. This great author on the diseases of the kidneys repudiates the connection between the symptoms of renal colic and vesical calculi, and between renal infarctions and vesical calculi. He admits having observed renal colic in the first year of life, but in a single baby only. Now this is very unfortunate, and can be explained only, I believe, by some characteristics in the field of his observations. Exceptional cases, such as those of Woehler and Denis, in which a renal calculus consisting of uric acid was found in a premature and stillborn fœtus, need not be counted at all. But the observations of Heusinger relating to the frequent occurrence of renal calculus in the first year of life are more conclusive. I met with renal calculus quite frequently when I had more opportunities to make autopsies of young infants, and have often alluded to a series of forty post-mortem examinations made on babies who died of miscellaneous diseases, in six of whom I found a renal calculus. Nor do I believe I am mistaken when I express my conviction that many of you have observed actual gravel in the very young, and many more the violent spasmodic pains of infants, accompanied with erections, dysuria, even convulsions, and sudden relief mostly attended with urination.

It is evident that the presence of crystalline masses in the tubes and papillæ of the kidneys is liable to be dangerous. They encroach upon the soft tissue in which they are imbedded, disintegrate the epithelium, irritate the surface, and produce slight hæmorrhage and inflammation. In many cases of nephritis of the very young there was a distinct history of dysuria and of copious deposits in the napkins, not infrequently mixed with blood. What gravel and stone can accomplish in more advanced months and years is more easily brought about in the half-perfected tissue of the newborn.

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In regard to the dangers attending the presence of uric acid in the kidneys I have more to say on preventives than curatives. When we deal with gravel and stone in the kidneys of adults our efforts are directed to the solution of the deposits. Plenty of water, alkaline mineral waters, alkalies, mainly potassic salts, lithia, piperazine, and lysidine are pressed into service. In the newborn, in whom we must, as infarctions are the rule, except the presence of the danger, we are in the habit of doing absolutely nothing, though prevention be within easy reach. Water is, if not the panacea, at all events the indicated remedy. But in no period of life is water more withheld from the helpless creature than in the first few days. Mother's milk is not forthcoming until a few days have passed by, and then it appears in small quantities only. Even the experience that the newborn lose weight by being starved is charged against Providence, which has willed it so from times antediluvial. If water were given plentiful and as methodically as syrup of figs or castor oil, much harm could be avoided. And here permit me a few words *pro domo*. In regard to feeding the newborn, I have practised these forty years, and taught thirty-five, not only that the very young infant must be fed, but that its artificial food must be greatly diluted. In those early times I knew only that the baby would best bear great dilutions, and I mixed a part of boiled milk with four or five parts of water, or rather of a thin cereal decoction. The latter have at last been recognized as correct, even by Heubner, whose main labors for years have been spent on studying and discussing the question of artificial infant food. But he still sets his face against what he calls "Jacobi's exorbitant dilutions." In the light of what I have had the honor of saying to-night, I profess to have even in those remote times taught better than I knew. At those times I considered the question of digestion only when I recommended large dilutions. It is only a dozen years ago, perhaps, that I began to consider the question of high dilution of the food of the newborn from the point of view of its beneficence in renal infarction and its consequences. In 1887 I spoke of its indication for the pur-

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pose of dissolving and eliminating uric-acid infarctions in my *Intestinal Diseases of Infancy and Childhood*. I can assure, as I said then, that since my advice of greatly diluting the food of the newborn, and giving plenty of water from the beginning, has commenced to be minded, I am sadly deprived of the many cases of gravel, dysuria, shrieking spells, and consecutive nephritis which were so common in former times.

The connection of *icterus* of the newborn with local changes in the kidneys is of vital interest. In the adult this intimate dependency upon each other is rare, though many gross anatomical changes are equally found in all ages. To that class belong septic infection, syphilis of the liver, cirrhosis of the liver of whatever origin, obliterations of the biliary ducts, thrombosis of the portal vein, and catarrh of the duodenum and choledochus duct.

In the newborn many undoubted cases of *icterus* are due to the destruction of red blood-cells in the first few days, and to the transformation of hæmatin into hæmatoidin (identical with bilirubin). Some of the latter comes from the many ecchymoses and stagnations, both in the skin and the subcutaneous tissue, due to the process of parturition.

The destruction of blood-cells in the newborn is a normal occurrence. According to Hayem and Hélot the blood-cells of the newborn are subject to rapid disintegration. According to Hofmeier the normal congregation of the blood-cells is absent; they exhibit a greater resistance to salving liquids; the number of leucocytes is very changeable, and the size of the blood-corpuscles is very variable. Silbermann found many blood-cells pale, others of normal color in their periphery only; many of various sizes—macro- and microcytes. He also met with nucleated blood-cells in the liver, the spleen, and the bone marrow; with cells of the liver, sometimes also of the spleen, and of the bone marrow containing blood; with red bodies of the club and biscuit form, evidently changed blood-cells; and finally an increase of leucocytes. All of these observations appear to prove the destructibility of the blood of the newborn, which is only equaled, or perhaps even surpassed,

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by the effect of chronic poisoning, in part observed for experimental purposes.⁷

By many the jaundice of the newborn is attributed to absorption of bile into the blood directly from the biliary ducts into the small vessels of hepatic circulation. By others a congenital narrowness of the choledochus duct or an accumulation of mucus in the biliary ducts, or œdema of the periportal connective tissue, or venous obstruction in the liver and consecutive compression of biliary ducts were claimed as the causes of jaundice. Quincke explained it by the patency of the ductus venosus Arantii, and by absorption of bile from the meconium of the intestines.

Meconium is rich in bilirubin. The latter is stored in it during and after the third month of intra-uterine life. Biliverdin accompanies it to such a large amount that Simon (*Arch. f. Gynäk.*, 1875) met with four per cent. of it.

This bilirubin and biliverdin are very liable to be absorbed through the open ductus venosus Arantii, which remains patent in seventy-seven per cent. of all the newborn until after the first week of their lives. Its circulation is free, its blood liquid, and there is a direct communication from the intestinal circulation with that of the vena cava.⁸

⁷ Toluylendiamine, according to Afanassiew and Stadelman, exhibits the following results: Dissolution of red blood-corpuscles and consecutive hæmoglobinuria; increase of the coloring matter of the bile; anæmia; moderate fatty degeneration of the large glands; acute parenchymatous nephritis; destruction of renal epithelia. At the same time the epithelia of the spleen and liver are seriously damaged either directly by the (experimental) poison or by the circulation of an altered blood. The urine contains copious conglomerate crystals, which probably are not organic, but consist of calcium sulphate.

⁸ Some communication of the same kind, with the same effect, is brought about between the hæmorrhoidal plexus of the rectum (through the hæmorrhoidal vein) and the vena cava, thus circumventing the liver. Still, it must be remembered that less absorption takes place in the rectum than in the rest of the

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Through the open ductus venosus Arantii the coloring matter of the bile enters the circulation of the whole body, circumventing the liver to such an extent that in some cases of icteric newborn infants it does not participate in the jaundice at all, and produces different degrees of icterus. When peristalsis is active, circulation and absorption are so in proportion, and icterus is early; when peristalsis is but sluggish, and meconium retained unusually long, icterus may appear at a late period. In premature babies the ductus venosus is large, and jaundice liable to be early and very intense. When Elsässer, however, found it closed in three cases no jaundice was observed. Immediately after birth the coloring matter of the bile is considerably increased, and therefrom results another additional cause of jaundice. Besides, as it has been stated, there is no period of life in which under normal circumstances so many blood-cells undergo rapid disintegration. Therein lies another cause for the formation of bilirubin, and for a direct thrombotic interruption of circulation in the smallest blood vessels. Finally, there is no period of life when elimination is less active than during the first days of life. At that time the urine is very scanty, the water supply mostly neglected, and the accumulation of effete material the rule.

Moreover, bilirubin is but scantily dissolved in the fluids of the tissues of the newborn; even in strongly alkaline solutions it is but slightly soluble, according to Hoppe-Seiler. Thus it is that the coloring matter of bile is met with in the urine of the newborn in the shape of the yellow masses (*masses jaunes*) which have already been mentioned in connection with urinary infarctions.

When the absorbed and deposited masses are but scanty they may be eliminated without any symptoms. When there is enough of them to result in a local irritation,

intestinal tract. Absorption is very much more active in the upper part of the large intestine. Kühne knew, 1868 (*Physiol. Chem.*), that icterus may originate in absorption from the colon; and in the small intestines both the amount of meconium and the absorbability of its bilirubin and biliverdin are much greater.

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they will cause albuminuria, which is often found in ill-nourished icteric babies. When there is enough to cause thromboses, which are quite common in the capillaries of the portal system, and obstruction of circulation, they give rise to hæmorrhages or to inflammation. As far as the kidneys are concerned, there is a peculiar anatomical reason why nephritis is very liable to appear in the very young.

The post-fœtal growth of blood-vessels and tissues varies considerably. It is least in the common carotid, largest in the renal and femoral arteries. The renal artery and the kidneys, however, do not develop proportionately; the transverse section of the former increases out of proportion to the volume and weight of the latter. Thus it seems that this disproportion between the size of the artery and the condition of the renal tissue establishes a predisposition to congestive and inflammatory conditions of the organ. Moreover, the resistance in the capillary net of the young kidney is unusually great. Experiments prove that the permeability of the capillaries is greater, and that within a given time a proportionately larger amount of water can be squeezed through them in the adult than in the young. This anatomical difference seems, therefore, to be an additional reason why renal diseases are so much more frequent in infancy and childhood, from all causes, with the only exception of that which is reserved for the very last decades of natural life—viz., atheromatous degeneration.⁹

In conclusion, Mr. President, permit me to recapitulate in a few words the main points of this paper:

Nephritis is a frequent disease of infancy and childhood and by no means very rare in the newborn. What was formerly considered mere albuminuria, or a transient form of it, we have been taught by improved methods of investigation, mainly by the use of the centrifuge, to recognize as nephritis. A predisposition to nephritis in the young is caused by the fragility of the blood-vessels in the

⁹ Heart and Blood-vessels in the Young. By A. Jacobi, M. D., *Brooklyn Med. Jour.*, March, 1888.

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newborn; by the relative imperviousness of the young renal capillaries compared with the large size of the renal arteries; by the feebleness of the young intestinal muscle, which proves insufficient to expel toxic contents; by the extensiveness and size of the young intestinal blood-vessels and lymphatics and the large size of the villi, all of which favor the absorption of toxins.

From an ætiological point of view, nephritis in the newborn may be:

1. *Congestive* (from feeble circulation, congenital heart disease, asphyxia, or exposure to low temperatures).

2. *Obstructive* (from the physiological rapid decomposition of the blood of the newborn; the formation of hæmatoidin=bilirubin; jaundice; the production of methæmoglobin by chemical poisons, such as potassic chlorate, or by excessive heat; or the presence of blood in the uriniferous tubes).

3. *Irritative* (from the presence of uric-acid infarctions or hæmatoidin infarctions, or purpuric or other interstitial hæmorrhages, or of microbes and toxins in the numerous eruptive and infectious maladies and in enteritis).

THE PREVENTION OF TUBERCULOSIS IN SCHOOL CHILDREN

LADIES AND GENTLEMEN:

Some weeks ago the Charity Organization published a *Handbook on the Prevention of Tuberculosis*. Among the contributors to it are some of the most eminent physicians and authors of New York. Thus its statements may well be accepted as authoritative. Indeed, I know of no volume which will communicate the same information on the subject of tuberculosis in as concise, handy, and skilful a manner. While commending its perusal to all my hearers, I know I cannot add to its wealth of ideas and its storehouse of truths. What is left for me, therefore, is to apply many of the facts to a special topic, namely, the problem of tuberculosis in connection with school teachers and pupils.

I do not feel certain that there are not many here who are well acquainted with some or most of what I shall have to say, for tuberculosis has for years been the subject of discussion, in lectures, societies, magazines, and newspapers. Some part of the subject is known to everybody. What we call consumption, that is, tuberculosis of the lungs with formation of abscesses and the usual or frequent termination of the disease in death, is of daily occurrence and many of you have met it amongst your friends and relatives. If statistics do not lie, there is no large company that does not harbor candidates or victims of the malady in some form or another. Is there anything that should be studied with greater persistency by those who, like you, are stationed between science and its application, and who have more ample opportunity to disseminate useful knowledge than most other professional people? Nor should the knowledge of the teacher be superficial. Only what is thoroughly understood can be applied or taught in plain words; and plain language is

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required when you mean to instruct a child, and through the child, its family. You have or will have to deal with the young at a time when his mind is most receptive and his tongue most communicative. That is why a number of plain rules are readily grasped and understood by a child, and the child taught by you may prove a teacher at home for his father and mother, who have not the time to read, though some of them may have more literary material than mere sensational newspaper gossip. In this way the knowledge of the nature and the prevention of tuberculosis may become disseminated, and the disposition to the dread scourge may be recognized and gradually extinguished.

Every educated person, certainly every one of you, knows perfectly well that tuberculosis is the direct result of the presence in large numbers of a minute microbe, the bacillus of tuberculosis, or its toxin (or virus) in the body of the patient. Its influence need not be immediate. It may be buried away in some part of the organism for a long time waiting for its chance. That chance will come when some other disease, particularly one of an inflammatory character, breaks out, or when such microbes as are the cause of or connected with suppuration, in small or large abscesses, combine their forces with those of the bacillus. In such a case the outbreak is apt to be a very sudden one and we have an instance of so-called acute tuberculosis or rapid, or florid, or hasty consumption.

Of the location and the frequency of tuberculosis in the very young I spoke a year ago at another place. In the infant and the very young child, where you personally have few opportunities of close observation, tuberculosis may be found as a chronic disease, in the end of a bone, or in a gland; also in the pleura and peritoneum; in its acute state mostly in the brain and a number of other organs where it is almost invariably fatal. In your profession you have to deal with children after the sixth or seventh years and with adolescents, in whom tuberculosis is very apt to follow the same course and exhibit the same symptoms which are met in the adult. Here you find it mostly in the lungs. In not a few cases tuberculosis may be easily recognized, or at least suspected. When you have to deal with a child that

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is unusually pale, or of low weight, easily exhausted, with glandular swelling about the neck and narrow chest, tuberculosis should be suspected and proper care should be taken, for it should never be forgotten that tuberculosis may heal or be made to heal.

As a modification, or as suspicious or incipient symptoms, you will not infrequently notice the symptoms of what has been called scrofula. Scrofula is observed in two forms. There are a number of children, usually brunettes, with dark hair, florid cheeks, brilliant eyes, low weight, quite frequently with good mental capacity, who display diseases of the mucous membranes; their eyes are frequently sore, some of the glands of the neck, perhaps many, are considerably swollen. The other form of scrofula is a more sluggish or torpid one. The children are rather heavy, flabby, mostly pale, with large and rather hanging cheeks, and big lips, and there is swelling of the nose and considerable tumefaction of glands about the neck, with not infrequently sore eyes, ears, and skin. This is the usual form, and the one which is apt to lead into tuberculosis during school age. That is why I wish to direct your special attention to this form of disease. Of great importance in connection with it is the presence of those glandular swellings round the neck, and it is to this that I ask your attention for a few minutes.

You know that the circulation in the animal body is two-fold—first, that of the blood; second, that of the lymph. The lymph is disseminated through the body in every organ, but particularly in and below the mucous membranes. The absorption of chyle as furnished by digestion takes place from millions of small glandular bodies, many of them of microscopic size only. They are disseminated over the intestinal mucous membranes, whose contents they absorb and carry off into larger vessels, and from them into lymph bodies or so-called glands of the mesentery, in the immediate neighborhood of the intestines. They are very numerous all over. From them the current goes on into still larger vessels until finally they terminate in a large duct, the thoracic duct, which discharges its contents into the circulation of the blood. That circulation in the lymph

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is very extensive and copious. It has been found that an artificial opening made into the thoracic duct of a young dog furnished lymph to the amount of between one-sixth and one-tenth of the weight of that dog within one day, while an adult dog furnished lymph amounting to only one-tenth to one-sixteenth of the body weight. In the same way the lymph apparatus in a young child up to advanced childhood and adolescence is very much more active than it is in the adult.

That is why the condition of the lymph glands in the young is of such importance. Whenever there is any infection of the mucous membrane, the infecting poison is carried off to the next gland where there is a stopping-place. That gland will become the seat of irritation or swelling. That is why—to give you an example—when-ever there is only a slight diarrhœa, no matter from what cause, over-eating, improper food, medicines, typhoid, colds—never from dentition, for there is no such thing as diarrhœa from teething in a healthy child—the lymph bodies in the neighborhood will swell. Unless such a diarrhœa is soon stopped the irritation will continue, congestion, inflammation, and swelling of the glands will ensue, and the structure of these neighboring glands will be changed. When such an inflammation of the gland has lasted a long time and new tissue has been formed in it, it may or will remain unchanged and unalterable, no matter what you may do for it.

The same takes place about the lungs. Whenever a baby or adult has catarrh with some cough and mucous expectoration, the neighboring glands in the chest—bronchial or mediastinal—will swell, and unless such catarrh is broken up the swelling may go on until the glands are hardened or undergo other changes. Sometimes they will form abscesses and break up. Whenever there is in a child or in an adult, particularly in the young of the age with which you have to deal, a catarrh of the nasal mucous membrane, the glands about the neck will immediately swell. This swelling will pass off when the nasal catarrh passes off. When it lasts long, when it becomes a chronic catarrh, the swelling of the glands remains; they become hardened, they

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are no longer amenable to the effect of medicine or to external treatment; they may finally break down and form abscesses. While they are in this swelled condition the lymph current through them will be interrupted, and whatever is floating in it will there be caught and infect the gland. Moreover, the minute capillary blood vessels are smaller in the glands than elsewhere, and microbes which are easily passed by capillaries elsewhere and finally thrown out of the system will be caught in the capillaries of the glands. In this way the glands around the neck, that were not primarily infected by disease-producing germs, may become the receptacles of disease. They may become tubercular when tubercle bacilli are floating in the general circulation (although they might have been carried off if the organs had been healthy), and be caught in the slow circulation of the gland and there remain. From there the invasion of the whole body may take place. Thus you see that, often in a healthy family or in an otherwise healthy child, a nasal catarrh of some duration may furnish the first inroad of tubercular bacilli. This is particularly so in infectious diseases which affect the mucous membrane to a high degree—for instance, in measles or whooping cough. Measles and whooping cough are often the forerunners of tuberculosis.

As long as the mucous membranes are in a healthy condition they may be covered with no end of foreign material, microbes included, with no danger to the individual whatsoever. There are, for instance, very few probably among us here that do not carry either bacilli of tuberculosis or bacilli of diphtheria in their noses and throats this very moment. As long as our mucous membranes are in a healthy condition the microbes will not be absorbed. As soon, however, as the membranes are no longer in that healthy condition, when the microscopical epithelia that cover the membrane are destroyed or altered or washed off, then those foreign guests, innocent up to that time, will creep into the sore tissues and the whole system will become affected. Thus it may even be that a healthy person, harboring the bacilli of diphtheria or tuberculosis, may infect other people though he has not been infected himself.

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The infection of the glands of the neck does not depend on a morbid condition of the mucous membrane of the nose alone; the vast area of the mucous membrane extending down to the pharynx and upward to the nose may be affected. There is no mucous surface that is covered and penetrated with small lymph bodies to such an extent as that of these organs. The lymph bodies in the hind part of the nose form, when they grow, what has been called adenoids. They sometimes reach such a size as to obstruct nasal respiration, compel the patient to have the mouth open to breathe, and cause him to hear and to sleep with open mouth, increasing the danger of infection on account of the wide access given to microbes floating in the air. In that condition the night is the most dangerous time. Adenoids and the whole mucous membrane have frequently been found to be covered with tubercular bacilli, more so than perhaps the tonsils.

When the bacilli are absorbed, their next lodging-place is, as I said, the neighboring glands. These glands about the neck form three tiers all the way down to the clavicle. From there the lymph current goes downward into the chest and into the axilla; thus the lymph bodies or so-called glands swell in the axilla and in the chest. These lymph bodies in the chest are in direct contact with the mucous membrane of the large wind-pipes, and in that way with the smaller wind-pipes and with the lungs. That is quite frequently the way in which bacilli and other virus enter the lungs. It is often the process in the adult and in the adolescent and in the growing child.

When you understand that, you see how important it is that the mucous membrane of the nose and of the mouth should be taken care of in the very young and in the growing child. A great many cases of tuberculosis, diphtheria, and other contagious and infectious diseases could be prevented if there were no diseased mucous membrane *greedy* after infecting material. That is why it should be a rule in every family where there is the slightest tendency to nasal and throat catarrh to irrigate the nose and the throat at least once a day, better twice a day, with warm water in which a very small dose of common table salt is dissolved.

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This so-called saline solution contains from six to seven parts of salt to one thousand of water. A good proportion for practical purposes is half a teaspoonful of table salt to a good tumblerful of warm water. Part of this should be filled into a common nasal cup, the head should be thrown back, and small quantities should be allowed to run down the nose into the throat. If it be swallowed there is no harm, but children will learn very rapidly how to bring up the salt water. In this way the mucous membranes are kept intact, and nobody can tell how many diseases are kept away by this very simple method. I can prove that it does have that effect, for you will invariably notice that whenever you have a catarrh of the nose, or even when you see a very severe case of diphtheria of the nose (one of the most dangerous forms of that disease), the large swellings of the neck will be reduced in a very short time by doing nothing whatever except following the rules just laid down. No medicine, no iodine, no mercury is required, simply the washing out—in an acute disease like diphtheria very often—every one or two hours. In common nasal catarrh, twice a day is sufficient to reduce from day to day, or even from hour to hour, the size of the glands, *unless* it have lasted weeks or months. Sometimes, even when it has lasted weeks, and not infrequently when it has lasted months, the correct irrigation of the nose twice or three times a day will gradually, within a few weeks or a month, not only reduce, but remove, the swelling that had been annoying for many months or even a year. In this connection I may say that nothing but irrigations should be used under ordinary circumstances, and no injections. No syringes should be used unless ordered by the physician in very bad cases of diphtheria, where it is important to remove a great many of the accumulated membranes in as short a time as possible. I will add, too, as a practical rule, that sprays, which are so frequently used, are not so effective either in disease or in comparative health. The washing out of the nose can be better accomplished by irrigations than by merely spraying.

What I have thus far said would settle in your mind the

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question whether scrofula and tuberculosis are identical. They are not identical, but they may become so. Imagine the original catarrh of the nose and throat, brought on by exposure, a drenching rain, cold feet, drafts in a trolley car, exposure of the perspiring skin, met with bacilli which had been innocent tenants on the mucous membrane; then these tenants of the surface would enter through the open door, and a real infection would take place. In that case, not otherwise, the scrofula or the alleged scrofula of the glands would turn out to be tuberculosis. Thus wherever there are swelled glands, wherever there is "scrofula," there is not necessarily at the same time tuberculosis, but there is danger of tubercular invasion. Scrofula, when fully developed in a child, as observed by you, will show a number of symptoms that are not found, as a rule, in tuberculosis. You have sore eyes, sore ears, swollen lips, and nose; you have the glands, you have the eczema of the skin; if all that were always tuberculosis there would be no possibility of recovery. The scrofulous disposition is widespread; it extends over the skin, over the mucous membrane, and may show itself even in the bones; it is characterized by the fact that whenever there is such an infection, whenever there is scrofulous irritation at least, it is *not apt to heal*. Scrofulous inflammation and ulceration are very obstinate. If all that were tuberculosis the patient would be doomed; but tuberculosis invades the body primarily in a certain limited locality. It may remain in that locality; it may remain in the end of a bone, in a number of glands, in a small part of the lung, and there may heal up. In the beginning, therefore, scrofula is a widespread *general* disorder and in the beginning tuberculosis is a *local* disease. That is why on the autopsy table we frequently find tuberculosis in a body where it was not suspected at all. We find deposits, small or large nodules, particularly in the upper part of the lung, usually the right lung, that are cases either of dormant or of recovered tuberculosis. No such thing is found in scrofula. When scrofula heals, the whole body is changed for the better. When tuberculosis heals, it is found that it was a local disease.

The invasion of tuberculosis into the human body may take place by inhalation of the bacilli, or by feeding, with

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the exception of the rare cases in which the bacilli get into the circulation through sores on the skin—in chronic eczema, for instance—or through wounds. Thus it is that butchers may contract tuberculosis of the skin from diseased cattle, or through an abscess. Milk containing tubercle bacilli may infect the intestinal tract, or (while being swallowed) the lymph follicles of the throat, including the tonsils, and thereby on their downward course, the body. From either of these places the circulation of the blood or of the lymph, mainly the latter, may be invaded.

The famous Dr. Emil von Behring, the discoverer or rather inventor of the diphtheria antitoxin, proclaims that almost every tuberculosis case, at any age, originates in the milk of tubercular cows taken by the infant or child. In most cases, in his opinion, tuberculosis remains dormant for many years, and every case of tuberculosis in an adult is the result of infection by tuberculous milk, during infancy. That is a cruel exaggeration. But surely there are *many undoubted* cases of feeding milk of tuberculous cows that resulted in tuberculosis. My late friend Olivier, of Paris, has the following report: Thirteen schoolgirls in a Paris boarding-school were taken with tuberculosis. Six died. Some of them had the disease first in their bowels. The milk came from a tuberculous cow with a badly affected udder. Johne, a great veterinary anatomist, examined the cow that had the reputation of being the finest on a farm until she became emaciated and died. Indeed, on account of her splendid condition, her milk had been selected by the farmer for his own infant. The child died of tuberculosis at the age of two years and a half. A case like this proves, besides other things, the correctness of my teaching these more than forty years, that it is always safer to select milk from a herd of cows than from a single cow, thereby diluting possible dangers. By experiment it has been proven that the milk of a tubercular cow when mixed with forty times the amount of healthy milk becomes devoid of dangers.

But, after all, cases of tuberculosis resulting from the ingestion of tuberculous milk are rare. In the stomach bacilli do not thrive, and tuberculous ulcerations of the intestines are infrequent. Indeed, the abdominal glands are more

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often affected than the mucous membranes of the intestines. The principal mode of entrance of tuberculosis is that of inhalation, which may be twofold: either that of the dry bacilli contained in the dust of the street, or of a room or public place; or of the moist particles of expectoration which are thrown about in a coughing spell and float in the air of a room hours before they are deposited on the floor. As far as the dry bacilli are concerned, it may take time and some force to remove them. A moderate air current is not sufficient for that purpose. Wherever they are deposited they are waiting for their chance. Dusting, sweeping of the dry material, will fill the air with bacilli. Children's respiratory organs, being nearer the floor than those of the adults, are most exposed. That is why the percentage of tubercular school children grows in disproportionate rapidity with every year of their lives.

Now, it may be worth your while to consider the final location of the inhaled bacilli; do they reach the finest ramifications of the bronchial tubes and the air cells? It is not probable, for in the advanced child and the adult the primary location of tuberculosis is not at all, or very rarely, in these distant parts. It is much more probable that during inhalation the dangerous inhalation is deposited in the posterior part of the nose and in the throat. There are those, however, who attribute to the tonsils the principal, aye, even the only rôle in the invasion of tubercle bacilli. A late author goes so far as to build his plan of preventing or combating tuberculosis on the total excision of the tonsils. That is an exaggeration. He claims the operation must be made according to a certain method, and, unfortunately, he suggests that there are but few except himself who can perform it so as to be effective. Moreover, it is not true that the tonsil absorbs as readily as the other thousand of lymph follicles of the nose and throat. In my studies on diphtheria, before and in 1874 and in 1880, I found that when the tonsil alone was affected, the case was a mild one, and not accompanied by much swelling of the neighboring glands; that these latter swelled principally when the diphtheritic membrane reached beyond the tonsil; and that when the mucous membrane of

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the nose was the seat of the diphtheritic membrane, the case was so grave that before those times and before the suggestion of local treatment, every case of nasal diphtheria was pronounced fatal by a great French authority of that period, Roger. I showed that the reason for the relative innocuousness of the tonsil is anatomical. Though its structure is similar to that of the smaller lymph follicles disseminated in the neighborhood, it is surrounded by a firm fibrous membrane which, to a certain extent, shields the system against a rapid absorption of poisonous substances which have entered the tonsils.

Other modes of entrance of bacilli into the system are the following: The finger nails of babies, like those of the adults, are unclean. Though they do not exhibit the unappetizing spectacle of a mourning ring, they are always unclean and harbor microbes, both uninjurious and injurious. A few years ago there was a report of a New York mother whose cheek was slightly scratched by her playful baby. The baby had erysipelas microbes under its nails, and the mother died of erysipelas. Thirty years ago I lost a warm friend, a great physician, who, while in quiet thought, scratched a small pimple on his cheek. His erysipelas originated in that very spot. Two German authors (Preisnitz and Schutz) published in 1902 their observations on the finger nails of children of from six months to two years of age. They proved that fourteen out of sixty-six had tubercle bacilli under their finger nails. No fixed star is more immovable than the fact that every one of these young ones had their dangerous pretty fingers in their noses and mouths. Now, tuberculosis will rarely make its appearance suddenly. Years may pass before the invalid lymph glands of the throat and neck give up their captive microbes and allow them to travel downwards. That is the time when your pupils develop their tuberculosis, no matter whether they imported it from the flying dust of the street or the dry sweeping of the rooms, from their own nails, from the crumbs they picked up, or from their intimate comrades, the toys.

Now, ladies and gentlemen, I have repeatedly spoken of the fact that microbes, no matter in what numbers, may

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invade the nose and throat and are devoid of danger as long as the mucous membrane covered by them is healthy, but that they prove, or may prove, dangerous when a catarrh destroys the fine film of epithelia which protects the surface. That is why a cold is always enumerated amongst the causes of tuberculosis, of diphtheria, of rheumatism, even of erysipelas or of scarlatina. As practical people and bent upon caring for yourselves and others, you will ask me for the methods of keeping the mucous membranes in a sound condition, and thus preventing disease. That can be done by attending to the general health, and mainly by the hardening process.

Much has been said about *hardening*. What does it mean? Nothing but this: that the resistance of the child to the effect of external influences should be strengthened. Is there a uniform method applicable to every child, no matter of what age or constitution? Certainly not. But there is one object which should be accomplished in every infant and child, viz., the invigoration of external circulation. The surface of a child from two to ten years measures from three to ten square feet. In and under that surface there is a lake of blood. In vigorous health this blood is in constant and rapid circulation; within two minutes it enters and leaves the surface, comes from and leaves the center of circulation—the heart. Slow circulation in the surface retards the flow of blood in the whole body, and impairs the nutrition of the heart and every organ, causing congestion and insufficient function, and disease. Rapid circulation in and under the skin, causing rapid circulation everywhere, propels the totality of the blood in the child's body (from two to six pounds according to age—from two to twelve years) into and through the lungs, in which the contact with and the absorption of the oxygen of the atmosphere take place. Now, the best stimulant of the circulation in general is, besides muscular exertion (exercise), the stimulation of the skin by cold water and friction. A child of two or three years should have a daily cold wash, either after a warm bath, or standing in warm water which covers the feet, or lying on the attendant's lap, or on a mattress. A brisk rubbing

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with a wet towel one or two minutes, and with a dry towel until the surface is dry and warm, is sufficient. Older children may have a wet sponge squeezed out over them, this procedure being followed by the same effective friction; or they may plunge into cold water, in the winter a single moment, in the summer several minutes. While in any bath, the skin should be thoroughly rubbed.

This rule must not become a routine applicable to every individual. Cold water and friction require a healthy heart and a certain degree of strength. A usually healthy child, when taken sick or when convalescent from a disease, lacks the necessary vigor, and the routine must be interrupted. A child under size and under weight requires warmer water and friction. That is why a newly born baby or an infant of less than one or two years should be spared a low temperature. This is also why a child whose feet, after a bath or washing, do not get so warm as the rest of the body should be rubbed down, not with cold, but with warm water, or with a mixture of alcohol and warm water in which table salt or sea salt has been dissolved.

It would be wrong, however, to rely on a single method alone for the purpose of preserving the healthy condition of the skin, the mucous membrane, or the general circulation. Whatever aids or injures one part of the body is apt to aid or injure all. No child can have a normal circulation in the chest when the abdominal organs are compressed or their circulation interfered with. Children, for instance, who suffer from constipation, no matter from what cause—I have described one form which results from an abdominal length and bending upon itself of the lower end of the large intestines,—or others who suffer from prolonged sitting, or those who bend over on account of near-sightedness, all compress their abdominal blood vessels, and are often afflicted with nose bleeding, congestive headaches, and general ill-nutrition. That is one of the frequent occurrences which necessitate the watchful care of a school physician and of the teacher.

Physicians and humanitarians have always protested against premature schooling, too long hours, and too short

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recesses, and objected to overcrowding of the curriculum, and to the vanity of incompetent schoolmasters and mistresses, who utilize the poor victims in behalf of exhibitions. Mostly in vain thus far. In regard to the exhibitions, and the examinations preceding them, I am sure Dr. Weir Mitchell has struck a keynote. Only last week in a public lecture delivered in Philadelphia, he expressed himself strongly in regard to the influences exerted by the worry and fear and over-exertion connected with school examinations. It is true enough that without some sort of examinations the standing of the pupils in large schools is hard to determine, but, on the other hand, whoever has seen much of children or young people about the time of examinations must be fully satisfied that some modification or other must be discovered.

Now, as to school hours. A child of seven or nine years should not have more than two or three hours daily in school, one of which should be spared for an intermediate recess. From nine to twelve years the school hours should be three or four; after that age, not more than five hours, with frequent and ample recesses. The best exercise during recesses is play in the open air. Compulsory gymnastics in badly ventilated localities cannot take its place successfully and may add to exhaustion and ill-health. It is an unfortunate fact that, when the claims of physical development were urged upon school authorities, gymnastics were added to the overcrowded curriculum as a matter of business interest or of conviction, not always willingly or intelligently.

The summer vacations of school children ought to be four weeks longer than they are. The public schools ought to be closed about the middle of June and reopened in October. Many years ago the Harlem Medical Association and the Medical Society of the County of New York requested the Board of Education of the city to open the public schools on the *third* in place of the *first* Monday in September. The soundness of the principle was appreciated and the necessity for such a change was acknowledged by the authorities, and the *second* Monday of September was selected for the beginning of the school season, so as

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to afford the children an extra week's broiling in the city's sun and an opportunity to lose, as they did formerly, the benefit derived from the summer vacation. The sanitary reason of this loss of a beneficent opportunity was said to be the anachronistic conviction of an eighteenth-century school superintendent, who said he preferred the influence of the schoolroom to that of the New York streets for the New York boy.

Teachers are principally concerned with questions connected with the condition of the school buildings. They should be ample and sunny and not moist; they should be exposed to fresh air, have ample light and sufficiently large rooms. All that appears to be understood, but in this very New York we know that not everything is done that could or should be done in regard to all these postulates. There should be ample light, not only for the purpose of being enabled to see the dust where it accumulates and the mud, but light is a remedy in itself. It is true that only in the last very few years has it been utilized for the direct cure of general and particularly of local diseases, but it was known previously that disease-giving microbes that live a long time in dark places will be speedily destroyed under the influence of light.

Air space should be ample. It is difficult to say exactly how many cubic feet are the proper supply. The amount of cubic feet in a schoolroom, which is occupied a number of hours only, need not be what it is in a living-room, in a bedroom or in a hospital. In the latter more than 1000 cubic feet for a person is the least that should be demanded. We all know that there are few persons, comparatively speaking, in New York, with its immense tenement-house population, that have as much air supply as that, but we all know how their health suffers from that reason. A schoolroom that is occupied only a short time may perhaps furnish about 200 cubic feet for a child. A room of 30 by 25 feet and 12 feet high, containing 9000 cubic feet of air, should not harbor more than 50 children. At best that would give 180 cubic feet for each child. I have known of a schoolroom, indeed, of many schoolrooms, that were meant for 60 children and contained for

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a long time an excess of 130. It is natural that a good deal of sickness must be the result among teachers and pupils.

Everybody is theoretically convinced that the blood cannot be fully aërated, and that the health must suffer, unless the air we inhale is pure. The young organism suffers in this respect more than the old, for it requires more oxygen, comparatively. Unless a sufficient supply of oxygen is kept up and the percentage of carbonic acid contained in the air is below seven-tenths of one per cent. good health is impossible. The deteriorations you have to fight in the air of your schoolroom are as follows: It is too dry under the influence of our heating apparatus. Furnaces and most other heaters furnish a dry air which impairs the surface of the mucous membranes in the nose, the throat, and the lungs. There is no more voracious oxygen eater than the gas stove. Carbonoxid is the result of imperfect combustion, and a very frequent deadly poison. So are the chlorine gas and the nitric and sulphuric acid contained in our coal supply. They are liable to change former health resorts, on account of the increase of factory chimneys, into questionable or dangerous localities. Add to this—and you cannot exclude them—the dust of the houses and streets with all it contains, particles of stones, metals, vegetable remnants, and microbes, and, further, the poisonous exhalations of the skin and intestines such as sulphides, and you will no longer wonder why there are so many cases of catarrh, bronchitis, pneumonia, infectious fever, and tuberculosis.

The heating should be considered one of the most important factors of health or disease. The first requirement of a good heating apparatus is to give no dust and not to render the air more dry than it naturally is. Our wind in New York is mostly west wind, that deposits all the moisture before it reaches us. That is why, as a rule, our air is very dry; that is why our buildings dry out so rapidly that they may be inhabited as soon as finished, and our linen, exposed to the air, dries in a few hours; and that is why our heating apparatus should supply us with a certain amount of vapor. Our furnaces furnish a dry heat; so

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does most of our steam heating. The result is frequent catarrhs. The temperature of a schoolroom in dry weather should be about 64 degrees, in wet weather about 68. I have been in many schoolrooms that are surely overheated. In order to modify the heat windows were opened. The children sitting under or near these windows contract in a great many instances a catarrh, and even pneumonia, and I have seen them die from such exposure. Perhaps it is too much to expect circumspection and mature judgment from a young teacher. But there should be no such thing as a really immature teacher. We are learning from our predecessors, the rules of hygiene are well understood, and the people have a right to expect they should be known and obeyed. In that respect, as in many others, a schoolroom and a school building, like a hospital, should be models for the whole population, but not dangers. The halls of a school building should be slightly cooler, but slightly only, than the schoolrooms, in order to avoid drafts and a sudden change of the temperature.

If what I have brought before you was partially known to you all, it is a source of gratification to me. The main points connected with the origin and prevention of disease should be known to every educated person. Only in this way the public at large, which has to rely on superior judgment and is unfortunately more readily led astray than guided correctly, can be benefited. We doctors are never more pleased than when our patients understand the why and wherefore, in the same way that you are most enchanted with pupils that ask for and comprehend the why and wherefore. Unfortunately no walk in life is proof against ignorance. Moreover, our education is too often an instruction which runs in ruts. Nothing is more common than that men and women of good minds and moral instincts should be satisfied or compelled, by lack of time or opportunities, to neglect widening the horizon of their mental possessions beyond what is nearest to their profession or inclinations. That is why thousands in our better classes are so often the victims of quackery and sectarianism, of faith cures, clairvoyance, and un-Christian "sci-

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ence." Faith belongs to the realm of religion, not of science—of the other, not of this world. Now, the professions of doctor and teacher are least apt to be caught by glittering improbabilities or impossibilities. We teach the realities of both the physical and the intellectual world. That is why it has given me intense pleasure to speak before you, though well aware that in a brief time I could present to you but little that is foreign to you, or too little of what you had a right to expect. In what I have said there may be, however, a few practical points of value. In your professional work, and in your social contact with the little and the big ones, you will have ample opportunity, I hope, to put them into effect.

CAUSES OF EPILEPSY IN THE YOUNG

THE two series of the Index Catalog of the Surgeon-General's library contain 125 columns filled in close print with the titles of books, pamphlets and magazine articles on epilepsy. In the presence of such a mountain of erudition, I felt I could do no better than to refer the anxious litterateur to those wonderful volumes, the pride and honor of American medicine, and confine the few minutes at my disposal to the elaboration, in as few and as plain words as possible, of some personal experiences, beliefs, and criticisms connected with the causes of epilepsy in the young. I take it that meetings like these should add to the learning collected in libraries the inspiration of personal intercourse.

The *predisposition* to epilepsy may be inherited, or acquired during intrauterine, or during extrauterine life. Intoxications of the parents by morphin, lead, or alcohol, their infection with syphilis or tuberculosis, their constitutional anemia, gout, or diabetes, or a local degeneration of either testes or ovaries may not cause in the offspring the identical disease or anomaly, but only a general debility of the tissues or their innervation. A variety of causes may have the same result, and a variety of results may follow an identical cause. Quite often the unexpected is the rule, and a general neuropathy is more frequently observed than a direct inheritance. Still, epilepsy appears to be more directly inherited than any other cerebral disorder. In Echeverria's 533 cases, 29.72% showed a direct inheritance from an epileptic parent; Gowers has a percentage of 35; according to Spratling, 66% of the epileptic children have epileptic parents. Whether, and to what extent, *matrimony between* relatives contributes to mental disease or degeneration is by no means proved. From theoretical reasoning, from personal experience, and from

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the incompetence of statistics, which are amenable to a contradictory variety of conclusions when handled by different reviewers with different horizons and standpoints, I cannot admit that two healthy persons, be they ever so closely related, must, for the reason of consanguinity, have a diseased child. But to what extent the state of the future will interfere with the marriages of insane or epileptic people, as also with those of carcinomatous or thoroughly tuberculous, remains to be seen. I can imagine and believe that the offspring of the intellectually and morally healthy couple will—other things being equal and barring the accidents of pregnancy and birth—serve the improvement of the race, while that of the abnormal must impair it. From that point of view we should look forward with hopeful expectations to a little more paternalism in our government. There is no country in the world in which a monarchy is less probable, and the government of, for and by the people is more certain to come than in ours; for there is none in which the organization of capital and the organization of labor are making such rapid strides towards a peaceful evolution of socialism as in ours. That is why the younger men among us will live to see the time in which the sanitation of the country and people, guided by the legislative influence of the medical profession, will render impossible the perpetuation of deteriorating or loathsome diseases.

It is probably impossible ever to ascertain the exact *number* of infant or young epileptics. Neither public institutions nor specialists are in a position to gather exact statistics. Very few are as favorably situated as Gowers, Binswanger, and others. Institutions are filled with patients in advanced years, specialists see them mostly in the same way. Many an epileptic infant or child dies before being observed or treated, or even diagnosed; for a great many cases of petit mal, vertigo, dream-like states and somnambulism, fainting, even hysteric spells, are overlooked. They are neglected or cared for at home, and the seizure is taken to be an eclamptic attack. An example of the kind is now in my hospital ward; a child with nephritis after scarlatina which ran its course four

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months ago. While practically in convalescence he was taken with an "eclamptic" attack a few days ago. As there was a daily renal secretion of from 500 cc. to 600 cc., a percentage of more than 2 of urea, and no indiscretion in his diet, the diagnosis of a uræmic intoxication was out of the question. That obliged us to inquire into his past, with the result of our learning the history of several unprovoked convulsions of epileptic character in the course of the last 18 months. It is the general practitioner who sees the cases and is able to judge of them according to their merits. He does not record them, but has more facilities to see them than even a public dispensary. Many of these patients are discovered in dispensaries and college clinics only after a number of attacks have occurred and succeeded in rousing the suspicions of the parents. With all these drawbacks, however, I am certain that I have seen many hundreds of such cases in the course of many years. The actual or the proximate *cause* of generalized epilepsy is in the cerebral cortex; its origin in anatomic lesions of different localities. Thus, epilepsy may be cerebral, it may be the result of persistently abnormal circulation, or it may be of a reflex nature. All sorts of cerebral tumors, solid or cystic; the results of previous encephalitis and meningitis, from insolation, otitis, nasal infection, or otherwise; disseminated sclerosis of different territories; "vasculitis" of the pia mater; the results of hæmatomata or of thromboses; arrests of cerebral development of heterotopy of gray substance; premature ossification of one, some, or all of the cranial sutures and fontanelles; even the narrowness of the occipital foramen; cerebral exhaustion from masturbation or premature venery, or local anæmia of known or unknown origin; diseases of the heart with secondary venous obstruction; congestion from other causes (in a case of Gerhard's, enlargement of the thyroid); the influence of prolonged use of alcohol or ergot; the sluggish brain circulation attending constipation and the general toxæmia of intestinal autoinfection; external irritations, such as peripheral tumors, cicatrices, foreign bodies, and the reflex excitement produced by carious teeth, Schneiderian hypertrophy, and nasal and

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naso-pharyngeal growths; vesical and renal calculi; helminthes, from tænia to oxyuris; in older children delayed menstruation, are so many different causes of epilepsy. It is, therefore, only the most painstaking examination of all the organs and the whole surface of the body which gives a promise of finding the cause of the disease as well as the indications for rational causal treatment.

Jacksonian epilepsy affects a localized group of muscles, and always the same; the spasm is mostly clonic and painless, and when it becomes generalized the attack begins in the same order. It is frequently, perhaps mostly, the result of a coarse lesion, a detached bone, a tumor, an abscess, a localized patch of meningitis, a hematoma, a cyst, a cicatrix, or a foreign body which by irritation sets up a series of epileptic convulsions. A (brachial) Jacksonian epilepsy was cured by the removal of a foreign body from the ear by Monflier. But this relation between a Jacksonian epilepsy and a local disorder cannot always be proved. Exceptions are very numerous; only lately Z. Bregman and N. Odefeld¹ came to the conclusion that "a tumor occupying a large part of the surface of the frontal lobe may look like a lesion of the central convolution. A persistent paralysis of monoplegic character and suggesting localization in the cortex with symptoms of Jacksonian epilepsy need not prove a lesion of the motor zone. Finally, there may be an extensive lesion of the frontal lobe without corresponding symptoms." I may add from my own experience that many a case of Jacksonian epilepsy, when examined postmortem, exhibited no tangible cause. That is also why many an operation undertaken for relief was futile.

Intrauterine influences, both inflammations and intoxications, are certainly powerful as occasional causes of epilepsy. Hereditary *syphilis* is considered a frequent cause of epilepsy, both Jacksonian and universal. The former results from the localization of an organic disease of the brain, either meningitis, or encephalitis, or softening, or gummatous infiltration. In accordance with their extent

¹ Grenzgeb. Med. Chir., 1902, p. 516.

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or localization there are symptoms of either paralysis or irritation. When epilepsy is universal or genuine, no such localization or local symptoms are met with. These cases show the fate of all those which permit of nothing but the assumption of an unrecognized cortical alteration. When children of five or seven years are suddenly attacked with epilepsy, syphilis should be suspected. These children are generally undersized and puny, such as Fournier has pictured as parasymphilitic. I have often seen and discussed them from that point of view, but must confess that though in the majority no serious nervous disorders seemed to mark their appearance, in many, however, though no history of syphilis of the parents could be elicited, visceral lesions were found in autopsies. Nor are other nervous diseases of early age exempt from syphilis. In hydrocephalus it is frequent, in poliomyelitis rare. In 200 cases of this form of paralysis, Sachs found only 2 that were attributable to hereditary syphilis. From a similar point of view mostly, the whole subject is thoroughly treated in a classical book on "Syphilis and the Nervous System," by Max Nonne, Berlin, 1902.

The conclusion should be that there are not many cases of epilepsy that can be directly attributed to syphilis. But a great many epileptics exhibit symptoms that make them very suspicious. Such are early imbecility or idiocy, glandular swellings, chronic periostitis, and anomalous teeth. Not infrequently I found in a family several cases, one case of epilepsy and others of different cerebral disorders. It appears, therefore, that the syphilitic virus, more or less modified, acts on the germ from the beginning of embryonal life with different results.

In this respect it resembles other influences which control the predisposition to epilepsy, gout, diabetes, hysteria, or insanity, which are prevalent in a family in one of the two preceding generations.

Many intrauterine influences exhibit themselves immediately or soon after birth. Among them I may be permitted to speak of hypertrophy of the brain, premature ossification of the cranium, and spurious meningocele.

Genuine *hypertrophy of the brain* is not frequent, but

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I have seen it once with epilepsy that began when the child was a year old and persisted until the autopsy was made three years later. The cranium was of normal thickness; 20 teeth had protruded. The dura mater was tightly adherent to the cranium, pale and tense. When it was incised the solid cerebral substance bulged through the incision. The brain surface was pale and flattened and the cortex of fair diameter; the white substance pale, hard, massive; the ventricles small, with no serum. As early as 1806² and 1828³ Lænnec reported that in several cases diagnosticated by him as hydrocephalus he found no serum, but the flattened convolutions of a pale, compressed, elastic brain. Hufeland (1824) admitted to have made the same mistake. It was he who first described the bulging of the elastic brain through the incision of the dura mater. His cases of this real cerebral hypertrophy—that is, a large brain within a normal skull—and those of other older writers are referred to in E. Noeggerath and A. Jacobi's "Contributions to Midwifery and Diseases of Women and Children," New York, 1859, p. 84. Altogether, however, these cases of abnormal hypertrophy of the *white substance* appear to be rare; they should be carefully distinguished from the large brains of Byron, Cuvier, Turgenieff, and Cromwell, that were symmetrically large. I think I am prepared to say that the epilepsy in my case resulted from the hypertrophy of the white substance and the compression of the cortex. There was no other tangible hypertrophy. Possibly it was the latter alone that caused it, for hypoplasia of the cortex is reported as the condition of a young man who died in an epileptic attack, by Ziegler in the second volume of his "Pathological Anatomy."

Hypertrophy of the brain, that is an abnormal and abnormally large brain enclosed in a normal skull, must be distinguished from *premature ossification* of the fontanelles and sutures. In this interesting condition we have to deal with an originally normal brain tightly enclosed in an abnormal cranium. In the book I quoted and in the *Journal*

² Journal de Méd. Chir. et Pharm., p. 669.

³ Revue Méd.

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of *Medicine* of 1857, I wrote "on the etiological and prognostic importance of the premature closure of the fontanelles and sutures of the infantile cranium." The observations of this anomaly were at that time only few. Extensive studies of the subject had been made by Virchow, Huschke, and Lucae. Hyrtl was the first to show that pathologic forms of the skull might depend on the premature closure of single sutures. Cruveilhier, Bailarger, and Schützenberger reported cases. Gratiolet studied (1856) the direct relation of cranial ossification in different races with their intellectual development and found, for instance, that the coronal suture closes earlier in the negro than in the white, and that the receding forehead and bulging occiput of the former depend on this precocity of bone ossification. I approached the question from a nosological point of view. A few of the conclusions at which I arrived, and which are still justified, are as follows: A brain, in order to arrive at its normal development, must have space. The normal closure, not genuine ossification yet of the sutures and large fontanelle, takes place about the fifteenth month of life. After that time the growth of the brain, which, however, does not entirely terminate before the sixtieth year, becomes very slow. When ossification is premature, the brain when normal cannot grow, is compressed in its entirety. When synostosis is uniform the shape of the head is nearly spherical, when it is local the corresponding part of the skull and brain is rather flattened, while the opposite is bulging. In this way the asymmetry of the skulls of many epileptics as described by Riecken and by Müller⁴ is easily explained. When the cranium is sunk in in one or more places, for instance on and above the two temporo-parietal regions, the case cannot be one of premature ossification over an originally normal brain, but is one of genuine microcephalus depending on an arrest of development. The suggestion of craniotomy or craniectomy in a case of real premature ossification may still be justified, the fatality or uselessness

⁴ Virchow's Handbuch, Vol. iv.

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of such operations notwithstanding. I have not changed my conviction on that subject expressed in my Roman address "*non nocere*" of 1894. Their performance by enterprising operators in cases of undiagnosed or mistaken microcephalia—no matter whether the fontanelle is large or small, or the bone is thin or firm—is no longer a medical question. Where nature made a mistake the doctor must not believe he can correct it by a crime.

The diagnosis is not difficult. When the case is one of ossification at birth it is only the exaggeration of what may be observed to develop slowly after birth. In these cases the cranial bones harden, the fontanelle decreases in size instead of its normal enlargement up to the eighth month. They may close at the third, sixth, tenth month. All the connective tissues of the cranium develop at the same rate. Many such infants begin to use their limbs early. The teeth appear early and not, as in occasional cases of rickets, in long intervals, but in rapid succession. The first teeth to appear are not, as in the healthy, the lower incisors, but the upper. These symptoms, together with the shape of the head as described before, justify your diagnosis. After a while the general development is disturbed by the increasing pressure, or irritation, by the interference with intracranial circulation, and by the additional danger caused thereby to every occurrence of a slight or serious ailment. During such a complication the first convulsion may take place. Often it occurs without any premonitory symptom, and will return in irregular intervals. Cases in which epilepsy of later years is due extensively to the compression of an originally normal brain in an abnormally compact and uniformly contracted skull I have seen. But more are due to or connected with a premature partial synostosis. There are but few normal heads and brains in the well absolutely symmetrical; but it is the fate of a great many epileptics to have a comparatively small cranial circumference and an absolutely asymmetrical shape.

Savage nations⁵ have made observations which show their

⁵ A. Jacobi: *The Intestinal Diseases of Infancy and Childhood*, Detroit, 1887, p. 103.

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fear of such an occurrence. The Makalaka of South Africa are always anxious to look for the location of the first teeth, whether in the upper or lower jaw. In Bohemia it is a popular belief that the child whose upper incisors come first will soon die. David Livingstone and Fritzsch report that some nations in Central Africa kill the infants whose upper incisors protrude before the lower ones.

Meningocele spuria means a fissure of the cranium and of the tightly adherent dura mater under an intact scalp. It is the result of a forceps operation, of a fall or some other trauma, of caries, or of syphilis. When the fissure is superficial it need not interfere with the development of the brain, for there is not even a permanent loss of cerebrospinal liquor, but when it is injured down to a lateral ventricle it results in porencephalia. Rhachitis of the cranial bones, and the interposition of brain substance between the fissured bones prevents spontaneous recovery. A practical recovery without operation may take place by the interposition of the membranes and of some periosteum. This spontaneous process may proceed kindly, but irritation of the compressed parts may cause meningitis and epilepsy. I made the autopsy, 20 years ago, of a child 5 years old.

I had seen her once when she was a few months old, with spurious meningocele attributed to a forceps operation. When she was about a year old she had a violent convulsion preceded by numerous spells of petit mal. Before she died these were numberless; severe epileptic seizures there were no more than half a dozen all told. She had a moderate amount of liquor in the lateral ventricles and some oedema and thickening of the choroid plexus. Round the fissure of the right parietal bone, which was closed by interposed cicatricial and hard tissue, there was inside a pale, hard pachymeningitis, the alteration extending over 3 cm. in every direction, and a thickened pia, pale near the origin of the affection, hyperæmic with large veins to a distance of 10 cm. or 12 cm.

It appears that with the possibility of its resulting in epilepsy even a spurious meningocele should not be left alone. A recent case demands the raising of the depressed

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bone and either bone or periosteum suture. Older cases, if pronounced inoperable, should be protected by a pad; iodine injections have proved successful; dropsical lateral ventricles may be drained.

In the foregoing remarks I have directed your attention to the unpromising results of intrauterine influences. Let me turn to another subject, in order to show that there are other powerful influences for bad, the results of which may be more frequently prevented than cured.

A frequent cause of epilepsy is *asphyxia* of the newborn, frequently the first born—no matter from what cause: moderate or serious compression of the fetal head, compression or prolapse of the cord, intrauterine respiration and aspiration of liquor amnii or meconium, placental detachment, morphine or chloral poisoning by the maternal blood, malformations of intrathoracic or intracranial organs, etc. The anatomical results in the cranium are excessive hyperæmia, tense veins, sanguineous effusion, extravasation, and thrombosis. When the baby lives at all, a meningitis or meningoencephalitis may follow, and paralysis in many cases; in many more, idiocy or epilepsy or both are the final results. In one-third part of the cases of idiocy there is a combination with epilepsy. In a long life I could trace the cause of the two latter to asphyxia in hundreds of cases. Without any suggestions, my question, Did the baby cry when born, or did the baby live when born? is answered that it did not; that the doctor worked over the baby minutes or quarter hours before it was resuscitated, and that the baby never was like other infants, never smiled at the usual time, took little or no notice, and had general convulsions sometimes beginning on one side, quite often. Hundreds of such cases I had opportunities to present at my clinics; never without the warning to my classes that the paramount duty of the practitioner is to shorten asphyxia, and that there is nothing connected with the management of a case of labor so vital as the prevention or shortening of asphyxia, the attendance upon the mother, though ever so urgently demanded, not excepted. A single moment more or less of the asphyxiated condition may decide the future

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of the newborn, and the presence or absence of a paralytic, idiotic, or epileptic misfit in human society.

The same danger accompanies intracranial hemorrhages not connected with asphyxia of the newborn. They are very frequent. The majority of babies who die in their first week succumb from that cause. The proximate cause may be found in disturbance of the circulation or in a trauma, but the disposition results from the incomplete embryonal structure of the blood-vessel walls. This disposition to extravasation is as great in the newborn as it is, for other reasons, in the senile condition of the arteries, very rarely the veins, of advanced age. The danger to life is increased in the former by the lack of coagulability of the fetal and infant blood which causes the extravasation to be very copious indeed. When it is not excessive, it may not destroy life—the more is the pity—but the clot and the secondary inflammation and degeneration, and now and then the final development of a cyst of the dura mater, will cause hemiplegia, paralysis, idiocy, epilepsy. Many are the instances in which I could find what pointed unmistakably to the connection of the hemorrhage with the subsequent life-long disturbance.

The frequency of *convulsions* in infancy and childhood is another danger. Those of the first six weeks or two months of life are of cerebral origin; that is the period in which clinical experience and Soltmann's experiments teach us that reflexes are absent or feeble. After that time convulsions are either reflex or toxic. No matter, however, how they are produced, every convulsion is a danger to the brain by the possibility of blood-vessel rupture. Small or large extravasations may occur in every convulsion, no matter from what cause, and endanger life, or mind, or health. The location or the size of the hemorrhage and the dignity of the affected part are of the greatest import. The danger is not so great when the fontanelles and sutures are not yet closed, and the expansible blood vessels may be able to harbor a larger amount of blood without being torn in their weakest capillary terminations; a fully or a prematurely ossified cranium furnishes a greater disposition to hemorrhage. All this may happen, no matter

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what caused the convulsion—intestinal irritation by undigested food or helminthes, acute intoxication by alcohol, cocci or bacilli or their toxins, in scarlatina, typhoid or influenza, uræmia, inanition, whooping cough or laryngismus. Two cases of epilepsy I remember distinctly that were caused by the convulsions of whooping cough. Another was due to an apoplexy in an adult. The unfortunate young man suffered from unmanaged constipation. I was called 40 odd years ago to see him in a fit of what was called a fainting spell. I found him on the water closet with an apoplectic attack that soon terminated in hemiplegia of the right side. A year afterward he had his first attack of epilepsy, which was followed by a great many more until he died, long after from what, according to the report of the case, appeared to be a second attack of cerebral hemorrhage. Cases of cerebral hemorrhage occasioned by a convulsion in a child can be treated, but rarely cured; but many may be prevented by the speediest possible interference with the attack. No case of eclamptic convulsion should be left alone. It requires chloroform, no matter what other indications present themselves. Shortening of a convulsion from any source, cerebral or reflected, by a single half minute, may just be in time to prevent a hemorrhage and subsequent death, or what is worse, paralysis, spastic encephalitis, idiocy, or epilepsy.

The *causes of convulsions* in infancy and early childhood are so numerous and their dangers so many that it may be worth our while to spend a few minutes in the consideration of at least a few of them, with the object of facilitating an early diagnosis and the possibility of immediate and correct treatment. They are so many, some of them not generally appreciated, that it will pay us to eliminate one at least that is credited with more mischief than it is guilty of. I mean *dentition*.

William Philip Spratling⁶ expresses himself as follows: "Next to heredity, it is my firm conviction that dentition, when severe, and *when acting on an organism that bears the impress of transmitted weaknesses*, plays the most important

⁶ Medical News, September 15, 1894.

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rôle in causing epilepsy in early life. Indeed, I fully believe that the importance of teething in this respect has not been accorded the careful attention it deserves." Dr. Spratling fortifies his position by quotations from Gowers and from replies received to a circular inquiry. From among the latter he prints quotations taken from letters written by me, Dr. G. Elder Blumer, Graeme M. Hammond, Frederick Peterson, and T. S. Clouston, of Edinburgh. From Gowers the following words are quoted: "Of all the cases that commence in infancy, at least three-quarters date from infantile convulsions ascribed to teething." I wish you to note that the words are "ascribed to teething," not due to teething. I have no doubt he meant to say "ascribed to teething by the men who sent me the cases and their histories." Gowers' says, literally: "The influence of the process of the eruption of the teeth is relegated to its proper place, as merely a possible excitant in a few cases." From my letter Dr. Spratling quotes as follows: "Every convulsion, ever so slight or short, may produce cerebral hemorrhage, with all the possible results—epilepsy, idiocy, paralysis, and insanity. Such cases are, unfortunately, frequent." You will notice that teething is not mentioned by me. I certainly did not believe, nor did I mean to infer, that the convulsions spoken of were due to dentition. Dr. Blumer expresses his belief that "there is no such thing as a convulsion due to dentition pure and simple and uncomplicated." Dr. Spratling himself emphasizes the requirement of the "impress of transmitted weaknesses" that one must go back of the dentition and regard the disturbance of this process as the "mere existing cause of the explosion." Dr. Hammond has "records of several cases in which convulsions, due to dentition, were followed by true epileptic convulsions." Dr. Peterson "can recall a number of cases of epilepsy due to the convulsions of dentition." Dr. Clouston is more positive than any of the three mentioned correspondents. He asserts that he has "seen the convulsions of dentition followed by prolonged delirium ending in idiocy, or in true

⁷ Clinical Journal, September 5, 1894.

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epilepsy, or insanity of adolescents." I again state that the convulsions giving rise to such cases of epilepsy are called by the last named three authorities "convulsions due to dentition." Neither Dr. Blumer nor myself go that far. I speak of convulsions only, no matter from what cause, and am, therefore, quite prepared to accept what I think I always knew and proclaimed to-day, and what Dr. Spratling expresses in a concluding remark, "that the spasms and convulsions of infancy are *serious* manifestations, and if allowed to go unchecked, may lead to explosions of genuine epilepsy, and later on to insanity."

Now what is dentition, and what its period?

It begins during uterogestation. The dental sacs of the 20 milk teeth undergo ossification in the fifth month of pregnancy. Behind them are the sacs for the permanent teeth. Their separation from the former is not completed until the fetus is born. Before and after birth there is a constant growth, the cartilage of the wall of the dental cavity and of the gums disappears gradually. The two lower incisors make their appearance between the seventh and eight months, the upper incisors between the eighth and tenth months, six more teeth between the twelfth and fifteenth months, four bicuspidis between the eighteenth and twenty-fourth months, the four second molars between the twentieth and thirtieth months. The second visible dentition begins about the fifth or sixth year. In the twelfth year four molars make their appearance, the last of the whole set, with the exception of the wisdom teeth, which protrude between the sixteenth and twenty-fourth year.

Thus the period of dentition begins about the middle of intrauterine life, and ends visibly first with the thirtieth month, and secondly with the twelfth year. It is principally the first which is charged with causing or being attended by convulsions.

Convulsions occur almost universally between birth and the thirtieth month; this happens to be the period of dentition. But it is also the period of *defective inhibition, of nephritis, otitis, pneumonia, enteritis, and infectious and cerebral diseases*. All of these are fruitful causes of convulsions; dentition goes on during that period, like the

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growth of bones and hair and nails, but it is not this physiologic process, but those morbid, mostly acute changes, that disturb the nerve equilibrium.

In regard to convulsions, infancy may be divided into two periods. One comprises the first two months. During that time reflex action is insufficiently developed. That is why convulsions at that time are almost always, perhaps always, of cerebral origin, and caused by hemorrhages, etc. The other begins with the third or fourth month. About and long after that time inhibition is insufficiently developed; that is why—while convulsions of cerebral origin are not excluded, the large majority are of a reflex nature. The slightest irritation of the digestive organs, of the integuments, or the organs of circulation gives rise to spasmodic muscular action which meets with no control on account of the absence of nerve inhibition. The difficulty of a correct local diagnosis tempts the attention in the direction of the known process of dentition. That is why the early periods of popular and of professional medicine—identical in so many centuries—and why the early period of a practitioner's life, filled as it is with the lack of circumspect experience—are replete with the diagnosis of difficult dentition, or the legend of the dangers of normal dentition, which, after all, is a physiologic process.

During the first year or two years of life—that means during that period of physiologic dentition which is most generally noticed by even the superficial observer, remarkable changes take place. The heart of the newly born and the young infant is comparatively muscular and vigorous, the carotid (and also the vertebral) arteries large, the blood supply to the head is ampler than at any other part of its life. The rapid growth of the head and brain connected therewith, or rather depending thereon, is a well-known fact. The salivary glands develop rapidly, their and the mucous membrane's over-secretion begins with the third month and is not the result of, but co-ordinate with, the later appearance of the teeth. The rapid growth of the cortex and of the anterior lobes, greater in proportion than that of the rest, explains the rapid increase of the infant intellect and the motor function. Physiologic hyperæmia is

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very apt to become pathologic on slight provocations, the more so as the embryonal character of the brain tissue changes only gradually in the course of a few years. These are no new facts. Even in a book on "Dentition and Its Derangements," New York, 1862, I could utilize a great many anatomical data, confirmed and added to since, when trying to find for dentition its exact place in etiology. My conclusions of 40 years ago I can still repeat. There is a certain amount of itching, even pruritus of the gums; there is a vasomotor disturbance in the shape of one or two flushed cheeks; now and then a slight muscular twitching; now and then a rolling of the eye caused by the incompetence of the muscles of accommodation met with in every infant to such an extent that strabismus is common in healthy babies; but when I said in 1887⁸ that I never in 10 years saw a convulsion due to dentition alone I here repeat the statement as valid for additional 15 years. Nor is diarrhœa a symptom of dentition, for infants either at a healthy breast or on well-selected artificial food have no diarrhœa. Do you wish another instance of the complete disappearance of dentition from the etiological horizon? When all of us were 50 years younger did we not hear of "dental" paralysis? Nowadays we do not even permit the term of "essential" or "infantile" paralysis. Poliomyelitis does not fall back upon dentition as a cause. And what is correct in the case of paralysis is so in convulsion. When a convulsion, the first appearance of, or rather the cause of consecutive epilepsy or idiocy, is attributed to dentition, the history of the case as submitted to us is incomplete, or our own diagnosis is at fault.

The high estimation in which dentition was held formerly has assumed smaller proportions, even among the maternal public. They do not insist any more as they did when you and I were 40 or 50 years younger upon having the baby's gums lanced over conspiring poor little teeth, just as little as they are clamorous any more for worm medicines for their pets to the former extent. The doctors who know how to make a diagnosis of a bronchitis, pneumonia, nephri-

⁸ Intestinal Diseases of Infancy and Childhood, Detroit, 1887.

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tis, otitis, or a toxic infection are getting too numerous, and the diagnostic atmosphere is gradually becoming purified.

Still, it is claimed that it is difficult to arrive at a diagnosis of the occult diseases of infancy. If the difficulty is, or were, actual, there is a remedy. See to it that the clinical advantages of our medical schools be so numerous and so perfected that no young or old doctor is in a position to accumulate more ignorance than knowledge. Convulsions in the young are of frequent occurrence in every practitioner's rounds. To treat it is something; to prevent it is better. This very day the number of infectious diseases, with their high temperatures and their toxins; the many intestinal disorders, with their nerve reflexes, are still all-powerful. There are still some meningeal affections that are not always fatal, but highly dangerous in their results. All this is well understood. But there is a class of diseases which leads as often to convulsions as any other; that is nephritis. I cannot help emphasizing the fact that it is common in the newly born and the very young infant; that infarctions and jaundice are a frequent cause; enteritis, with its indican and its toxins, engenders legions of cases; coal-tar medication is a frequent source of evil; exposure causes some; infectious diseases, from mild varicella to influenza or diphtheria or scarlatina, a great many. As the diagnosis is easy to make, requiring the examination of readily attainable urine only, I admit that the failure to arrive at a diagnosis is a constant source of surprise to me. Convulsions from that source are very frequent, and the vast majority of them, with their possible dreadful consequences, could be avoided. Many a case attributed to dentition could easily be recognized as nephritic.

Among the important constitutional diseases that have a great tendency to convulsions is *rhachitis*, not, as Gowers says, on account of the late general development caused by it, but for other reasons. His own words are as follows: "It is impossible to doubt that the dentition convulsions are a definite element in the causes of epilepsy. So constant, moreover, is their association with the defective development which we call rickets that it is impossible to

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doubt that the prevention of rickets would have a considerable influence in the prevention of epilepsy." In the further course of his remarks he defines as defective development mainly its retardation of the growth of the bones, emphasizing much less its influence on muscles, lymphatics and the large viscera.

The retardation of development hurts mostly bone and tooth formation. But nobody ever claimed that when a tooth is formed and protrudes late, it is for that reason a source of irritation and convulsion. The minor or major attacks of convulsions in rhachitis are always of central origin. They always mean the hyperæmia or œdema accompanying the rhachitical softening of the cranial bones. When rhachitis is limited to the curvatures of the extremities, or the development of a rosary or Harrison's groove, with ever so much deformity, compression of lungs, annoyance of the heart, and dislodgment of the liver and spleen, there is no convulsion. It occurs in craniotabes which, after a period of restless, cephalic perspiration and occipital baldness, begins with the third or fifth month of life. It is attended by hyperæmia and œdema of the galea, skull, dura and pia mater and brain, not infrequently with effusion into the ventricles. These central changes cause many cases of *tétany*, almost every one of *laryngismus stridulus* and a great many of the attacks of convulsions. Once started they return at uncertain times, and generally disappear with the recovery from rhachitis, produced by proper food and hygiene, fresh air and phosphorus. As long as they last they share the dangers of every attack of *eclampsia*, viz., œdema, thrombosis, hemorrhage. Not infrequently they last longer than the rhachitis that caused it. I do not care to speak of a convulsive *habit* and to explain the subsequent epilepsy by this habit; that would be no explanation, but another word only for the fact. The real explanation is afforded by the objective changes in the structure of the intracranial contents caused by the convulsive interference with the circulation of large and small vessels.

The local irritation of *phimosis*, congenital or acquired, complicated or not with *balanitis*, resulting from the changes

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of smegma or retained urine, may cause erection, sexual excitement and *masturbation* in the youngest infants. Head-aches have often been attributed to it, perhaps only on account of interrupted sleep; permanent nervous disturbances have been ascribed to it 30, 20 and 10 years ago more often than at present. Indeed, a London neurologist has gone so far as to make the statement that in 25 cases of epilepsy he found congenital phimosis 11 times. In the same way the nosology of some colleagues of our own country at one time explained spastic hemiplegia, polioencephalitis and myelitis, chorea, catalepsy, epilepsy, contractures, also idiocy by the presence of phimosis. Would it could have been true; for indeed if it had there would have been less paralyses, less epilepsies, less idiocies. In 29 of 30 cases of phimosis condemned to be operated upon I find gentle manipulation sufficient for a reduction of the usually slight ailment. I can say, however, that I never in my life saw such a case that I could ascribe to phimosis, and never a recovery from paralysis, idiocy, or epilepsy due to circumcision.

I have mentioned phimosis as one of the causes of masturbation, which has frequently been connected with epilepsy and other derangements of the nervous system. Masturbation was always recognized as a frequent occurrence in the periods of puberty and adolescence, but very rarely before 1875 in infants and children. Like its precursor, the persistent sucking of fingers, it is often semi-conscious action, more frequent in girls in earliest infancy, in boys later. Among its causes are manual irritation by nurses, or misfit trousers, featherbeds, excess of animal foods and stimulating beverages, rancid smegma under a long or narrow prepuce, eruptions on the penis, preputial adhesions, phimosis, vaginal and vesical catarrh, or vesical or renal calculi, oxyuris, constipation, horseback or bicycle riding. Unless it be continued too long, the unconscious infant and child does not permanently suffer from masturbation to the same extent as the adolescent. In the latter I am certain that epilepsy resulted from the habit in a good many cases. Such I have seen getting well when it was stopped, and under proper treatment—bromides a short time, cold water,

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lupulin, camphor, and other roborants, continued for years. Infants and young children are not so punished, except apparently in those cases in which masturbation itself is the result of a central disease. Goltz places the erection center in the cord about the fourth lumbar vertebra, others in the pedunculi cerebri or the medulla oblongata. It is quite possible that in such cases in which epilepsy follows masturbation, both may be of the same central origin. They are both probably incurable, and neither a treatment directed to the center, nor irritating vesicatories or brutal and vulgar clitoridectomy can possibly be expected to have an effect. Such cases of masturbation are as incurable as the vast majority of central epilepsy. What I express as my opinion of clitoridectomy is also valid in regard to worse methods. Baker Brown is dead, Everett Flood, of Baldwinville, Mass., appears to be very much alive.⁹ He eulogizes castration and circumcision. The former was performed on 20 males and two females. The cases were reported at the meeting of the American Medical Association at Atlanta. He admits that castration has "bitter opponents" of the same class that is "howling against vaccination." I do not howl against vaccination. To me it is a wonder that the criminal law of Massachusetts has not yet interfered with these attempts at dealing with masturbation and epilepsy, both of which render the consent to be mutilated an impossibility on the part of irresponsible, unfortunate sufferers.

⁹ *Atlantic Med. Weekly*, October 24, 1896.

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THE incomplete development of the sphincters, in the infant, results in the involuntary emission of urine and discharge of fæces. This condition prevails a year or two, and is not attended with any subjective sensation, or sensitiveness. The sphincter ani is the first to gain sufficient strength to retain the contents of the rectum; debilitating diseases occurring in later years may restore it to its original incompetency. The sphincter of the bladder attains a satisfactory power towards the end of the second year. When, however, its infantile condition persists beyond that period, both the urine and the genito-urinary organs being fairly normal, the involuntary emission of urine continues, particularly during sleep (*enuresis nocturna*), not infrequently through the day (*enuresis diurna*), or both in the night and during the day (*enuresis continua*). Many of such cases get well spontaneously about the period of puberty, when the whole genito-urinary apparatus undergoes a rapid development. In some the functional weakness, however, persists long beyond that time. Not long ago I had to relieve the case of a young lady of eighteen who was getting ready to marry. Most cases are observed between the third and the tenth year in both boys and girls, but the majority of the patients between the eleventh and the thirteenth year, also of those who suffer in more advanced years, are males.

The muscular debility of the neck of the bladder and the internal sphincter (in fact, identical organs) is sometimes but a part of a universal muscular incompetency, which is found among different classes of children. Some are slow, dull, and stupid, and lacking in general innervation; others are simply anæmic, ill developed, and generally feeble; there are some whose whole vitality appears to be expended upon their intellectual sphere: they are smart, quick, spirited, excitable, mentally vigorous though easily

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exhausted; but their muscles are thin, sensitive, and incontinence of urine is frequent. In many such cases the sexual and urinary organs are quite small. There are others, however, who exhibit no parallelism of debility in the urinary muscular apparatus and the muscle-supply of the whole body. In them there may be great muscular general development, and the neck of the bladder alone seems neglected. On the other hand, there may be great muscular power about the sphincter in an otherwise feeble and anæmic body. Thus, no certain rule can be established, and the diagnosis of the exact condition of things may become quite difficult. Still, there is a class of patients in whom the complication of enuresis with general muscular insufficiency is very apparent. Indeed, young men who after moderate venereal excesses suffer much from nocturnal or diurnal seminal emissions (with or without incontinence of urine) are frequently those who have a positive history of incontinence during their childhood. In them the whole muscular apparatus was defective; and the posterior part of the urethra, when narcotized, as it were, during sleep, gives way before the gentlest pressure on the part of the expelling muscle of the bladder.

Insufficient innervation has been alluded to as a cause of incontinence. Children who pass urine while engaged in eager play may suffer either from debility of the sphincter or from want of mental control. Particularly in diseases of the nerve-centers, with sopor and slow mental action, and where the development of the reflex apparatus is slow and defective, the sphincter, which contracts normally while the bladder is filling up, loses its control. Profound sleep is said to promote incontinence; still all children have that profound sleep, and but a small percentage are afflicted with incontinence. Such general constitutional disorders as scrofulosis and rhachitis have been charged with producing incontinence, but the vast majority of scrofulous and rhachitical children do not suffer from it. Slow carbonic-acid poisoning is also credited with resulting in incontinence; thus it is that G. W. Major and Ziem explain the incontinence of mouth-breathing children, and E. Bloch the nervous disposition, rest-

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less sleep, and vivid dreams in which the peripherous irritation of the expanded bladder is more readily perceived, thus overcoming the resistance of the sphincter.

Diseases of the spinal cord which lead to incontinence are rare in childhood. Tabes with incontinence accompanied by retention is of the very rarest occurrence, nor is spasm of the urethra, with consecutive dribbling while the spasm is passing, at all frequent.

Nor are local causes leading to partial patency of the orifice of the bladder occurrences which have to be taken into frequent account. Only adult age suffers from asymmetric hypertrophy or atrophy of the prostate gland, from foreign bodies, tubercles, ulcerations, and gangrene in the orifice, from fistula after parturition, from want of contractility after dilatation, and from injury after perineal section. It is true that exceptional cases of the latter kind may occur in the young; but, when they do, their histories are known and their results are easily accounted for. In a few instances I have met with polypoid excrescences at the neck of the bladder of very young girls. The removal of these granulations relieved the incontinence of urine.

While a large number of cases of enuresis are merely the results of the persistence of the infantile weakness of the neck, another series of cases depend on the increased reflex irritability of the bladder, complicated or uncomplicated with the above-described incompetency of the sphincter. That increased reflex irritability may depend on the bladder itself, or may have its source outside.

Expansion of the bladder with urine is a frequent cause of nocturnal incontinence. Hence the drinking of large quantities of water or other beverage in the evening must be prohibited. The effect of the urine contained in the bladder becomes the more injurious the more it is loaded with solid constituents. Urates and phosphates in superabundance are the results of large meals, mainly of nitrogenous material, and inadequate assimilation. The copious use of table-salt, and of salines in general, also of chlorate of potassium or chlorate of sodium, increases diuresis. Polyuria from a cause located in a nerve-center has the

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same effect on the bladder, and diabetes mellitus operates by both the large amount of urine and the alterations in its chemical composition. Cystitis in all its forms adds to the irritability of the detrusor: it is a frequent cause of incontinence when this makes its appearance in children whose micturition was normal before. Stone in the bladder has the same effect. Phimosis and tight adhesion of the prepuce may produce incontinence, particularly in those boys who are subject to frequent erections. The rest of the urinary organs exhibit the same influence. Thus in every case of enuresis with uncertain diagnosis nephritis, pyelitis, renal calculus, and vaginal catarrh must be searched for. As a result of incontinence of urine the bladder is apt to be very much contracted: it holds but little, and thus what was originally the result of incontinence becomes an additional cause.

Masturbation is not an uncommon cause of incontinence of urine. I believe that my paper on the subject of masturbation and hysteria in infancy and childhood¹ has directed the attention of the profession to the frequency of the habit of masturbation, with all its consequences. Now, in the young the caput gallinaginis is quite large, and Cowper's gland and the vesiculæ prostaticæ are sufficiently developed to result in erections. The constant irritation of the part by self-abuse leads to a chronic inflammation of the whole prostatic portion and the neck of the bladder, which is very sensitive. Infants addicted to the habit are very apt to escape for years its consequences as exhibited in somewhat advanced children; these suffer from general malaise, dull headaches, alteration of temper, and somnolence. The genital organs are mostly changed. The external parts—the vulva, the scrotum, and particularly the glans penis—are rather enlarged, and the urine is sometimes alkaline, and often slightly opaque with mucus, leucocytes, and spherical and oval epithelia, sometimes even spermatozoa.

The condition of the rectum must be carefully examined

¹ *Amer. Jour. of Obstetrics and Diseases of Women and Children*, February and June, 1876. See also Vol. III of this work.

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in every case. The plexus pudendus controls both it and the neighboring organs; the pudendal, perineal, and middle and inferior hemorrhoidal nerves are disturbed over the lower portion of the bladder and the vagina. Thus a rectal irritation produced by the retention of fæces, the presence of a fissure, which is much more frequent in infancy and childhood than is generally supposed, and the effect of worms (mostly oxyuris) in the lower end of the intestinal tract, are among the more common causes of incontinence.

Serious disorders of the nervous system, such as epilepsy or night-terrors, are also among the causes or complications of incontinence. They, however, and particularly the latter, need not be taken as causes only; in many cases the night-terror is but a result, co-ordinate with incontinence, of some distant, frequently digestive, disorder.

TREATMENT.—The great variety of the causes of incontinence of urine requires tact and discrimination in the selection of remedies. General anæmia and muscular debility indicate a diet carefully selected for its nutritiousness and digestibility. Gentle massage of the whole body, sponging with alcohol and water (1:6) or with water, and efficient friction with thick towels, sea-bathing, and the use of medicinal roborants, such as iron or arsenious acid, will always prove beneficial. The elixir peps. bism. et strychn. of the National Formulary is a good preparation for use in insufficient gastric digestion, with atony of the stomach; a child of three years may take a teaspoonful three times a day.

Attention must be paid to the capacity of the bladder. In every case, particularly in the evening, the quantity of fluid must be restricted. The sigmoid flexure and the rectum must be empty in the night, and patients should be encouraged to evacuate both bladder and rectum before retiring. After a few hours' sleep the children ought to be taken up and roused sufficiently for both purposes.

Muscular debility of the neck of the bladder (sphincter) requires general and local stimulation. Strychnine or other preparations of nux vomica prove effective to a certain extent by improving both the general innervation and the

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appetite; in desperate cases an occasional subcutaneous injection into the perineum (gr. $\frac{1}{40}$ - $\frac{1}{16}$) has rendered good service; an ointment of one part of extract of *nux vomica* in from ten to sixteen parts of fat, introduced into the rectum (size of a coffee or Lima bean) several times daily will also act well and can be continued for some time. The same indication is fulfilled by ergot, the fluid or the solid extract of which may be employed internally. The interrupted electrical currents is perhaps the most powerful local stimulant; one of the electrodes must be applied to the perineum, the other to the hypogastrium or the lumbar region. The advice to apply the negative pole to the interior of the urethra or bladder and the positive somewhere externally is bad, because of the danger of urethritis and cystitis.

Whenever there is oxalic acid or sugar or an excess of urates and phosphates in the urine, the source of the disturbance must be attended to. The digestive disorders forming the source of the anomalous condition require a corresponding change in the diet (diminution of nitrogenous food) or correction of the functional disorders of the stomach and liver. Until that object can be accomplished the prognosis is very uncertain. Vesical catarrh, nephritis, and the presence of a calculus in either the kidney or the bladder have their own indications; the consideration of which, as they are treated in other parts of this volume, is here omitted. The hyperæsthesia of the body of the bladder, complicated or not with catarrh,—it is often found without it,—requires belladonna or its alkaloid. Both belladonna and atropine are tolerated in much larger doses by children, in proportion to their size or age, than by adults. In many cases a single evening dose of extract of belladonna (gr. $\frac{1}{4}$ - $\frac{3}{4}$ -1) or sulphate of atropine (gr. $\frac{1}{100}$ - $\frac{1}{75}$) answers well, sometimes to an unexpected degree. Bromide of potassium (gr. vi-xxv), camphor (gr. ii-v), extract. humuli fluidum (min. iv-x), or the elixir humuli of the National Formulary in teaspoonful doses, given at bedtime, answer a similar purpose.

Causes of reflex contraction located in the vagina, penis, or rectum require local correction. Vaginal catarrh is as obstinate because of its inaccessibility as it is frequent.

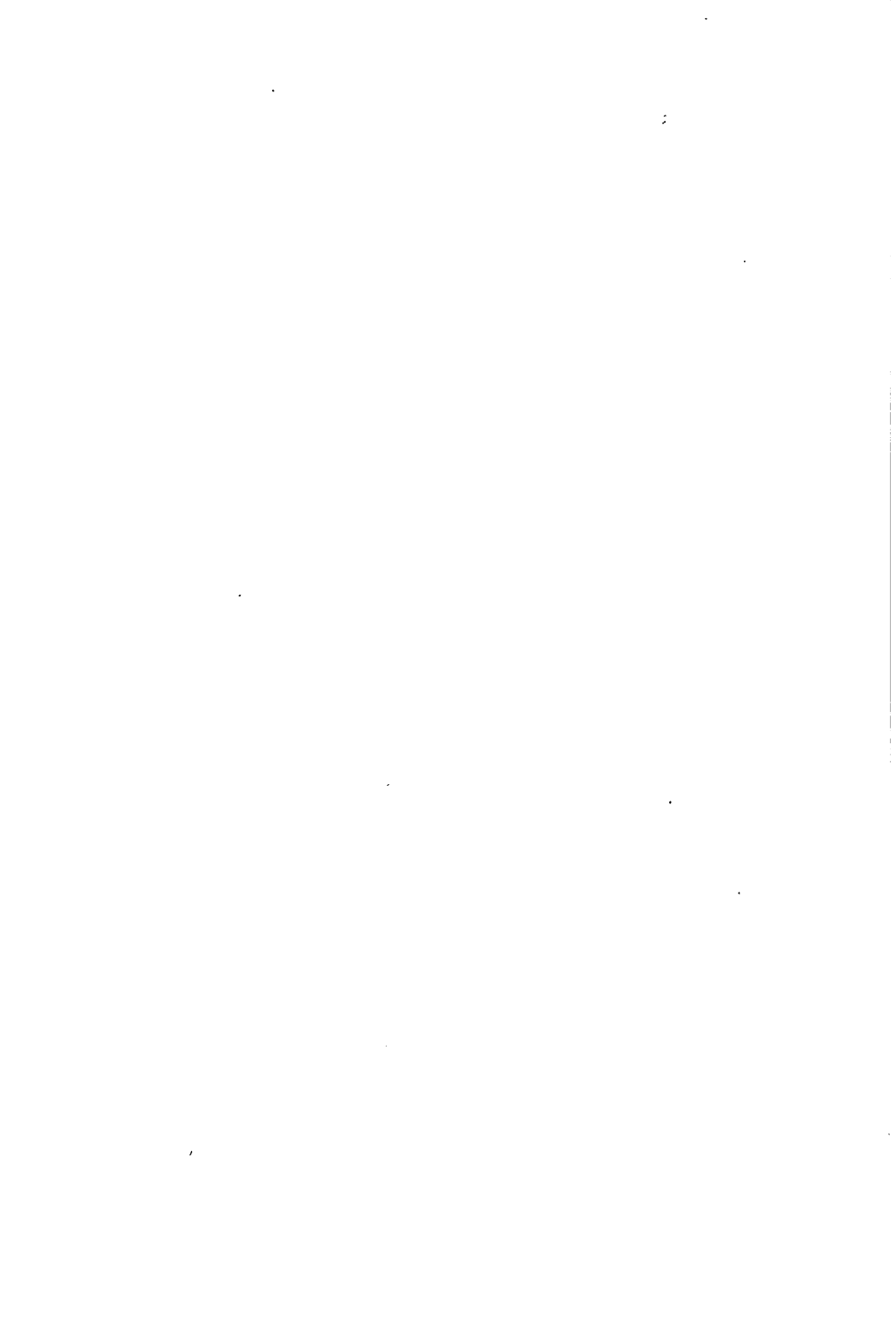
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Polypoid excrescences about the vagina or in the urethra (of the female) must be removed; if there be phimosis, circumcision is required. But a great many cases which are presented for that purpose could easily be remedied by gentle dilatation of the prepuce. Firm adhesion of the prepuce requires careful detaching. Intestinal worms must be removed, and the fact remembered that oxyuris has its original seat in the upper part of the colon and the lower part of the ileum, so that rectal injections have but a temporary effect in most cases. Fissure of the rectum, mostly of small size and located posteriorly, requires forcible dilatation, a procedure which demands no time and no anæsthetic, but is very efficient.

Irritability of the neck of the bladder and the prostatic part of the urethra has been treated by Henry Thompson with cauterization by means of a two-per-cent. solution of nitrate of silver. A solution of one part in a thousand of distilled water will be found sufficient, or a solution of one or two parts of tannin or alum in a hundred. Still, it is a better plan to introduce either an elastic catheter or a metal sound into the bladder, every few days, for two or four minutes. A few drops of a solution of cocaine instilled into and distributed in the urethra a few minutes before the insertion of the instrument will in many cases render anæsthesia superfluous.

The latter, however, cannot always be dispensed with. In the case of a girl of three years, with chronic catarrh of the bladder and incontinence, anæsthesia was required a dozen times, for two purposes,—first, to inject a solution of nitrate of silver (1:1000) into the bladder, and, secondly, to dilate forcibly, with increasing amounts of water, the organ, which had habituated itself not to hold more than a few drachms of fluid at a time.

Masturbation, which is so frequently the cause of irritation of the prostatic portion, has its own indications. Its cure is by no means easy. Infants can be watched and forcible prevention of self-abuse (mostly by the thighs or hands) exercised; but children of more advanced years require an unusual amount of firmness and supervision. Bodily punishment will avail but little; in the treatment of incontinence from whatsoever cause, nothing.



RACHITIC DEFORMITIES: ETIOLOGY, CLINICAL HISTORY AND LESIONS

I RISE with much diffidence, for I am to discuss a subject with which you are familiarized from day to day. You see these rachitic deformities so frequently that I am afraid I shall repeat, from my point of view, things which are to you matters of daily observation and experience.

Our subject is the etiology and the lesions of rachitic deformities. By way of introduction, I would say that rachitic deformities are something new in our country. You have seen so many of them that undoubtedly the younger men here do not remember the time when there were no rachitic deformities in this country. Thirty years ago there was no rachitis, except very rarely a stray case. At that time, when I spoke of rachitis and endeavored to demonstrate a case in my clinic, I had to hunt considerably for material to illustrate this condition. When, twenty-two years ago, I wrote a paper on the first cases of cranio-tabes I had seen in New York, it was, with the exception of one by Parry, of Philadelphia, the first paper on this subject ever written in our country. The subject of rachitis, therefore, is a comparatively novel one. Since that time, immigration has been going on, and the poverty-stricken people from the slums of Europe have been accumulating here. As with the greater facilities for transportation science has been equalized all over the globe, so poverty, bad air, and want of every description have equally spread constitutional diseases here. Since then we have seen much rachitis here. Thus it is that the treatment of rachitis in the future, although it will always remain medical, will also be a social question.

The principal causes of rachitic deformity are numerous—the rapid growth, the thick epiphyses, the soft diaphyses, the condition of the ossification cartilage, the traction of

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the muscles, the debility of the muscles, and the pressure of the atmosphere. The locality where the deformities are found depends largely upon the intensity of growth. Growth is most intense in the young child—(1) in the cranium; (2) in the chest; and lastly only in the extremities. I recapitulate only what you all know when I speak of the rachitic head, with the thin skin, the dilated veins, and the open sutures and fontanelles for two, three, four, or even nine years, as I have seen it. The edges of the sutures are irregular. Such a head is usually large—actually larger than the normal head—relatively it is very much larger when compared with the frequently small body. It is so large that it resembles sometimes the hydrocephalic head. Indeed some of these heads are to a certain degree hydrocephalic; some are entirely so. Most of them are brachy-cephalic, quadrangular, with depression on top. In a peculiar class of cases, first studied by Virchow, that of the cretins and semi-cretins, rachitis is combined with a premature ossification of the occipito-sphenoidal synchondrosis. In this condition the base of the skull is shortened. At the same time there is a deep grooving of the root of the nose, the eyes are widely separated from each other, there is shortening of the vomer, and the flat palate so characteristic of cretinoid conditions. Not infrequently the occiput is slightly flattened, and the oblique diameters are sometimes not equal, so that one side may appear to be entirely flattened. This is particularly the case when we deal with rickety softening of the cranial bones—craniotabes. In such cases there is much perspiration, with loss of hair on the occiput; the veins are more dilated, the skin thinner and paler than in the average head. In these cases of craniotabes one side may be flattened and the other side bulging. The head may even appear to be triangular. Where one side bulges out, and one side is flattened from pressure, the forehead is very prominent, sometimes even from three to five times its normal thickness, because of an immense amount of new periosteal soft growth between the periosteum and the bones, which produces a marked deformity of the forehead. This is not always a temporary

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affair. It is true that craniotabes may leave no trace if it gets well sufficiently soon, but when there is much deposit under the periosteum, it will sometimes remain. When calcification takes place very suddenly, then the thickening of the bone will remain unabsorbed for life. As a rule, however, most of such thickenings are absorbed.

The condition of the teeth is certainly one which should be considered in connection with rachitic deformity. The teeth appear late or irregularly; when early, the intervals between the first crop and the second, or between the second and the third are very long—sometimes six, eight, or ten months. The teeth are frequently discolored, and they decay very easily. Sometimes, however, we find in the second crop that the teeth are very hard and very yellow. Not infrequently we see "Hutchinson teeth" in rachitic children. This is one of the reasons why Parrot got the idea of explaining every case of rachitis as the result of syphilis. The lower jaws are short, narrow and very low, the angles very sharp and prominent. The alveolar processes turn inward. Thus, the teeth of the upper jaw do not cover those of the lower jaw. The chin in some cases is very low. From the foregoing remarks it will be seen that well-marked rachitic heads present a very peculiar appearance.

The trunk in rachitic persons is very short. The clavicle shows much perisoteal thickening; it is very frequently bent forward by the pulling of the muscles, and there is not infrequently an infraction between the middle and anterior thirds.

The chest is the seat of a great deal of deformity. It is frequently triangular, sometimes quadrangular; the dorsum is flat and the scapula clings to the body. The ribs being soft, form a groove in which the arms are frequently buried. There is a predominance anteriorly. On account of the atmospheric pressure laterally above the diaphragm, there is a horizontal groove, called "Harrison's groove." As there is compression above the diaphragm the lower ribs stand outward. As the chest is compressed laterally the sternum is made to protrude, particularly about the

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third and fourth ribs, and the antero-posterior diameter is lengthened. The ribs are prominent at the ossification point. On the cartilages there are frequently nodulations; a complete rosary may be developed quite early. I have seen it at the age of two months, and a case has been published in which there was a complete rosary in a baby of only three weeks. In these extreme cases the sternum is flat, and the manubrium stands out; frequently it is pressed down above so as to stand out at an angle at its lower end; the lower end of the sternum may be retracted while the ensiform process protrudes.

Kyphosis is very frequently seen in these cases. It is often but an exaggeration of the normal curvature. Scöliosis has mostly its convexity to the right with compensation above and below. The spinous processes are very frequently directed to the concavity. The intercostal spaces are very narrow on the left side, because there is less curvature of the ribs, and the ribs are bent out.

In the grown-up woman the antero-posterior diameter of the pelvis is shortened. This is not seen to the same extent in the babe. In the normal baby the pelvis is small and the sacrum very steep, not concave as in the adult. Therefore, when compression has taken place because of softening, it is still smaller so that often it is quite difficult to examine the pelvis satisfactorily; the sacrum may be so changed as to give rise to a convexity inward and contraction of the two sides. This narrowing may be due to the mere fact that the softened bones are compressed on the pillow, or by the arms of the nurse, a pressure which is slight, it is true, but quite sufficient. In very mild cases the symphysis is changed but little. In a number of instances, however, it will be found to be bent forward, and thus in very early rachitis, the rachitic pelvis is very similar to the pelvis deformed by osteomalacia. This is contrary to the usual description in the books on obstetrics.

The extremities suffer in different ways, in all their parts—the epiphyses and diaphyses, the periosteum, and the epiphyseal cartilages. The epiphysis is frequently thick and painful, particularly on the forearm and tibia.

RACHITIC DEFORMITIES

A number of cases of so-called "growing pains" are simply instances of rachitic epiphysitis. Sometimes the thickening is very considerable; in most cases it is uniform, but in some it is more developed laterally. This is particularly the case on the upper part of the thigh. The diaphysis is usually bent. Semi-fractures take place in the arm, clavicle and legs from a very trifling application of force. The periosteum, however, being soft, always acts as a shield to the inflamed bone when exposed to the danger of fracturing. In all those cases in which there is much curvature, particularly in the lower extremity, the concavity is inward, and on the forearm and thighs it is very often anteriorly. The difference in the direction of the curvatures depends on the influence of the muscular traction, or of the weight of the body. In the very young the concavity of the lower extremity is inward because of the effect of the flexor muscles. When the bones become or remain soft in those who attempt to walk, the weight of the body results in outward curvatures, and lesions of many kinds.

The ligaments are very flabby, and give rise to flat-foot in children that stand up and attempt walking. The periosteum suffers a great deal, and in different ways. It is softened and exhibits a thick layer of rachitic deposit. Calcification occurs in time, and then the diaphysis will be much thicker and harder than in normal conditions. The bones of rachitic patients, when recovered, are solid and able to stand a great deal of hardship in later life.

In the rachitic periosteum there may be hæmorrhages. Not infrequently in bad cases of rachitis, and in those cases which in the course of general illnutrition develop purpura, there are hæmorrhages under the periosteum in the lower and upper extremities. Many such cases of decided rachitis, and those which exhibit similar hæmorrhages without being marked by rachitis, have been thrown together under the heading of, in this country, "scurvy," and abroad, "acute rickets." In all of these cases, the children are ill-fed; there is a great deal of pain in the lower extremities and feet, sometimes with and sometimes without periostitis. The hæmorrhages will heal and

DR. JACOBI'S WORKS

leave a thickening in part of the cases. Hæmorrhage of gums is not a requisite for the diagnosis; it may be absent in those who have no teeth, or who have; and present even where there are no teeth.

Finally, deformities consisting of shortening of the whole limb are due to the early calcifications of the epiphyseal cartilages. It is on this physiological function that the length of the diaphysis depends. When calcification is complete, the growth of the bone, and that of the limb ceases.

I wish to remind you that rachitis is a general constitutional disease. In it we have to deal not only with the general system, particularly with another part of the locomotor system—the muscles. The muscles suffer just as well as the bones in rachitis, and give rise to certain deformities. Both voluntary and involuntary muscles are affected. What has been called rachitic pseudo-paralysis, is not paralysis; it is simply a weakness of the muscles and nothing else. We should have been spared this new term. The muscles are simply poorly developed, and in consequence they are easily fatigued. The involuntary muscles suffer in the same way.

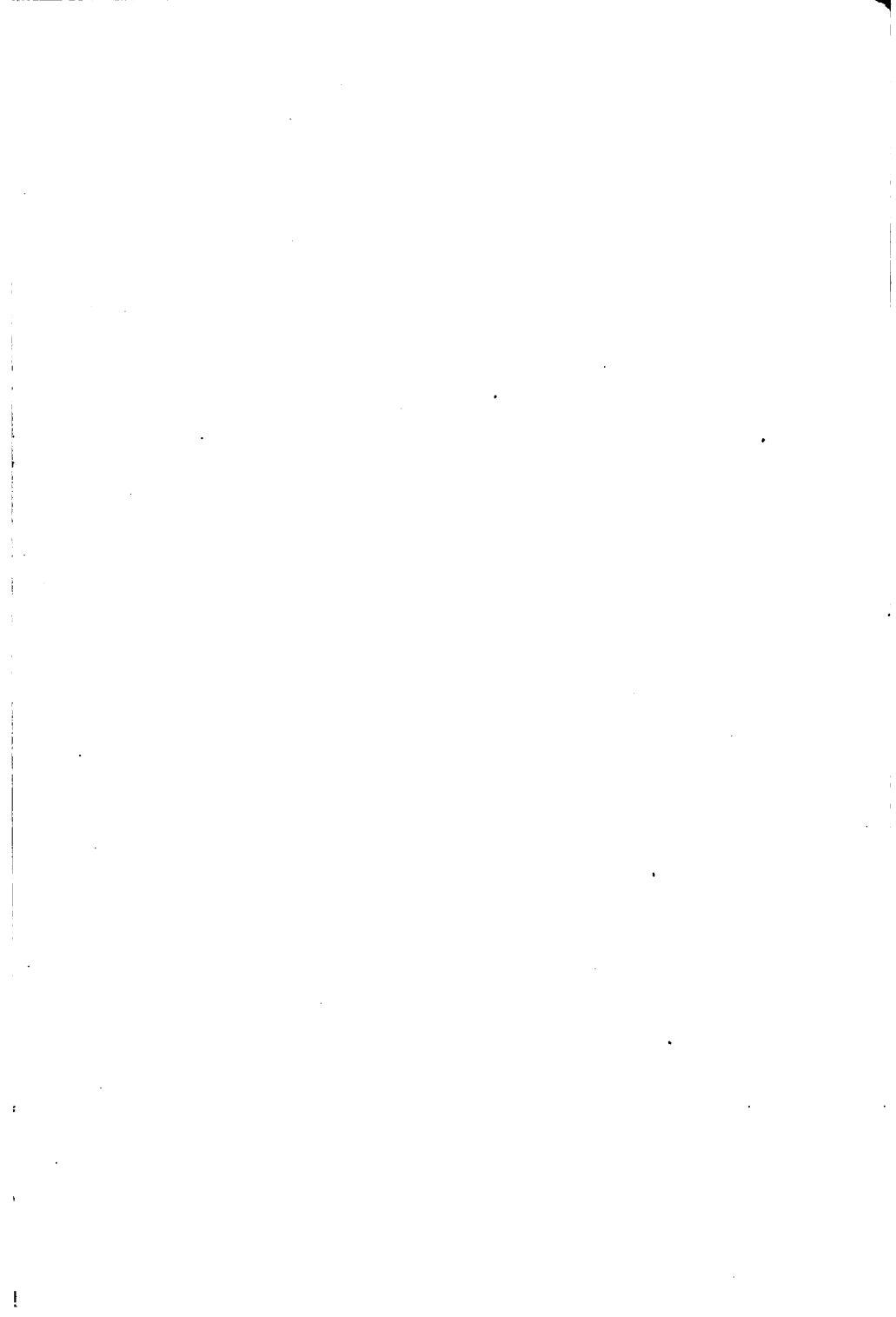
While the muscular tissue is poorly developed, fat is liable to be ample. Rachitic children, unless emaciated by pulmonary or intestinal diseases, are apt to be heavy and rotund, and their weight and appearance are often mistaken for healthy development. But they are flabby, anæmic, and not capable of resisting attacks of ordinary diseases like well children. They prove, moreover, that weight alone is not the measure for healthy and steady evolution.

The muscles in such subjects are flabby, and consequently the stomach is apt to be dilated, and the muscular layers of the intestine are apt to yield, thus giving rise to large, flabby abdomens filled with gas, on the surface of which are dilated veins.

The expansion of the intestines, owing to the weakness of the muscles, gives rise to constipation. This constipation is characteristic. Rachitic children become constipated very early. It is sometimes the first symptom of rachitis,

RACHITIC DEFORMITIES

and shows that the muscles participate in the process at a very early stage. It may begin at the second or third month of life in a child presenting evidences of fairly good nutrition; and it at once leads us to suspect rachitis. Some deformity of the abdomen may be due to the spleen, liver and kidneys. In consequence of "Harrison's groove" the liver and spleen are not infrequently displaced, and these organs for the same reason may appear larger than they really are. The kidneys may be found floating. Most of the cases of floating kidneys occurring in children that I met with were in rachitic children, showing Harrison's groove well developed. But there are cases in which the spleen and liver are actually enlarged, from slow congestion and interstitial hyperplasia. They cause the same deformity that is occasionally seen in syphilitic subjects. This is another reason why Parrot came to the conclusion that every case of rachitis must be syphilitic.





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